Optimal Decision Making by Thai Management: Focus on the Enterprise Information System

by

Thunyanee Pothisarn
BBA (Accounting and MIS) Thammasat University Thailand, 1997
M.Sc. (AIS), Chulalongkorn University Thailand, 1999

Submitted in fulfilment of the requirement for the degree of Doctor of Philosophy

School of Accounting and Corporate Governance
Faculty of Business
University of Tasmania, Launceston

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Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other institution, and to the best of my knowledge, this thesis contains no material previously published or written by another person, except where due reference is made in the text of this thesis.

Thunyanee Pothisarn

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List of Abbreviations

Abbreviations	Full description
ANOVA	Analysis of Variance
B2B E-commerce	Business-to-business Electronic Commerce
BI	Business Intelligence system
BOM	Bill Of Material
BU	Business Unit
BW	Biological Warfare
CE	Concurrent Engineering
CEO	Chief Executive Officer
CRM	Customer Relation Management
D&M IS Success Model	Delone and McLean IS success model
DoD	Department of Defense
DoD TDQM	Department of Defense Total Data Quality Management
DW	Data Warehouse
EGAT	Electricity Generating Authority of Thailand
EDI	Electronic Data Interchange
EISs	Enterprise Information Systems
EOQ	Economic Order Quantity
ERP	Enterprise Resource Planning
ES	Enterprise System
FTA	Free Trade Agreement
IASB	Independent Accounting Standard Board
ICT	Information, Computer and Technology
IQ	Information Quality
IQA	Information Quality Assessment
IS	Information System
ISO	International Organisation of Standardization
IT	Information Technology

Abbreviations	Full description
JIT	Just-In-Time
L/C	Letter of Credit
LSD	Least Significant Difference
MAI	Market of Alternative Investment
MBNQA	Malcolm Baldrige National Quality Award
MEA	Metropolitan Electricity Authority
MIS	Management Information System
MIT	Massachusetts Institute of Technology
MRP	Material Resource Planning
MYOB software	MY Own Business software
NIE	National Intelligence Estimate
PAPI based	Paper and Pencil based
PC	Public Company
PhD	Doctor of Philosophy
PSP/IQ	Product and Service Performance/Information Quality
QFD	Quality Function Deployment
RQ	Research Question
SAP	Systems, Applications and Products
S-B-R framework	Source-Bearer-Receiver framework
SCM	Supply Chain Management
SCOUG	Southern California Online Users Group
S.D	Standard Deviation
SE	State Enterprise
SET	The Stock Exchange of Thailand
Sig.	Significant
SME	Small and Medium Enterprise
SPSS	Statistic Package for Social Sciences
T/R	Trust Receipt
T/T	Telegraphic Transfer

TDQM	Total Data Quality Model
Abbreviations	Full description
THB	Thai Baht
TOC	Total Cost of Ownership
TQA	Thailand Quality Award
TQM	Total Quality Management
U.K	The United Kingdom
U.S.A	The United State of America
UTAS	University of Tasmania
WCM	World Class Manufacturing
WTO	World Trade Organization

Abstract

The main objective of this study is to examine information available from the current enterprise information systems of Thai manufacturing companies and to determine whether the systems meet the information requirements of users. The enterprise information systems are recommended as being able to provide the requirements of every business. As a result, many Thai organisations are spending a lot of money to adopt enterprise information systems, especially the enterprise resource planning systems, hoping to get high quality information to support their decision making and gain business competitive advantages. This study argues that the enterprise information systems deployed in Thai manufacturing companies ought to provide certain quality characteristics of information and specific items of information that are useful for supporting managers to make good decisions.

The survey method was considered an appropriate method and two surveys were conducted. The first survey was done as structured interviews to gain an understanding about tasks, responsibilities, decision issues and required information from four Thai large organisations' CEOs and departmental managers. The major purpose of the first survey was to obtain the data to construct the main survey questionnaire; those data were reinforced by the best practice suggested by academics and trade associations.

The three-ring model was developed to examine the information situation from three aspects: the best practice from academic and trade association literature; information required by users; and information currently available from the existing information systems. The main survey was conducted with large Thai manufacturing companies listed on the Stock Exchange of Thailand (SET) that had total fixed assets over 200 million Thai Baht (THB) in six industrial groups(246 companies). Seventy-nine questionnaires were returned, generating a 31.44% response rate. The quantitative data were processed using SPSS program version 17.

The results show that there are gaps among the three aspects of information. The best practice aspect is quite similar to the level of information required from the information consumer's point of view but there are substantial differences which suggest that neither

managers nor systems designers are fully aware of what items of information are required or of their quality. Another clear result is that the level of information from existing systems is significantly less that the level required and, as a corollary, significantly less than best practice. These present the gaps that need to be improved.

The findings of this study identify both the gaps of information available from organisations' information systems and the misunderstandings of information system experts, as well as supporting the idea of using academic and trade associations' best practice to guide the information consumers to indicate their information needs. They also contribute to information theory by providing empirical data about how information systems fall short of the ideal.

There is also an opportunity to conduct research to test the model with other industry sectors, where the unit of study would be selected from a different population of organisations.

Last but not least, the research framework and method of study developed and used in this study have the potential to assess the availability and quality of information from information systems and show how system designers should pay more attention to the users' requirements. Future researchers can also extend the investigation to other types of business activity.

Chapter 1

Introduction

1.0. Background

In decision making information is important to management. Much of the information used in the decision-making process is collected in an information system. The data are sorted, classified and then presented in a form useful to decision-making and operation of an organisation. Business information is recognised as a medium for the communication and transfer of knowledge. Marchand (2000:3) states that "Information is the way people in business express, represent, communicate and share their knowledge with others to accomplish their activities and achieve shared business objectives". Some researchers have also addressed the important role of information in supporting business decision-making and control (Chapman, 1993; Wilson, 1993; Pearlson and Saunders, 2004).

This study will focus on the information needs of managers in Thai manufacturing companies. Thai manufacturers are facing significant challenges in the form of increased global and domestic competition. One of the major causes has been the cost of labour relative to costs incurred by major competitors. This increased competition has mainly come from Vietnam, India and China as they enter the global market with more competitive product pricing and cheaper labour costs. Competition has also intensified with changes in Thai government policy which has resulted in the country becoming a party to over 300 Free Trade Agreements (FTA) and World Trade Organization (WTO) agreements. These agreements have meant that cheaper products have entered the Thai domestic market from other countries.

The internet has made it easier for potential customers to search for and choose the best deal for products in terms of price and quality from manufacturers around the world. This means that manufacturers, competing in the global market, need to improve to remain competitive in the face of increased competition. The traditional competitive advantages of Thai manufacturing companies, such as low costs and product differentiation, are no longer sufficient to enable them to compete effectively in the changing market place.

In an effort to meet the challenge of competition in the global market, manufacturing companies are investing in information systems to improve the quality of information generated about their operations and to improve their capacity to meet the changing needs of the competitive market place. For example, the adoption of enterprise resource packages (ERPs) by many large manufacturing companies has been undertaken to implement best practice performance and to enhance decision making capability (Davenport, 1998; Davenport, Harris, and Cantrell 2004; Arunthari, 2005; Arunthari and Hasan 2005). In Thailand there has been little research to evaluate this strategy and the potential benefits are still not well understood. Enterprise information systems (EISs) have been adopted by 52.2 percent of Thai companies (Arunthari, 2005). Arunthari and Hasan (2005) suggested that the Thai companies adopting ERPs believe that this system is an essential tool for a company to be successful in the competitive market place.
In this study, it is argued that the enterprise information systems deployed in Thai manufacturing companies should provide certain qualitative characteristics of information that are useful for managers' decision-making. More than that, the system should provide management information that is useful for managers to make decisions. It may guide management to a better understanding of the true potential of an organisation and its ability to achieve efficient and/or sustainable results.

1.1. Contribution to theory and literature

This study has the potential to contribute to knowledge in several ways. First, this study will add to the growing literature on the topic of information management and information science and will provide up-dated information on the nature of information used to inform management decision-making in Thai manufacturing organisations. Second, it will provide a valuable input to the models of information needed to optimise Thai managers' decision making, by identifying the nature of information available to managers in Thai manufacturing organisations and their needs for particular types of information. Third, this study also has the potential to enhance the understanding of the relationship between the needs of users of information (managers) and the providers of information systems (systems designers). Last, this study will contribute to an

understanding of how Thai manufacturers utilize enterprise information systems to provide information.

1.2. Purpose of Study

The purpose of this study is to examine the information available from current enterprise information systems of Thai manufacturing companies and how well that information meets the decision-making needs of managers in those companies.

1.3. Conceptual Framework

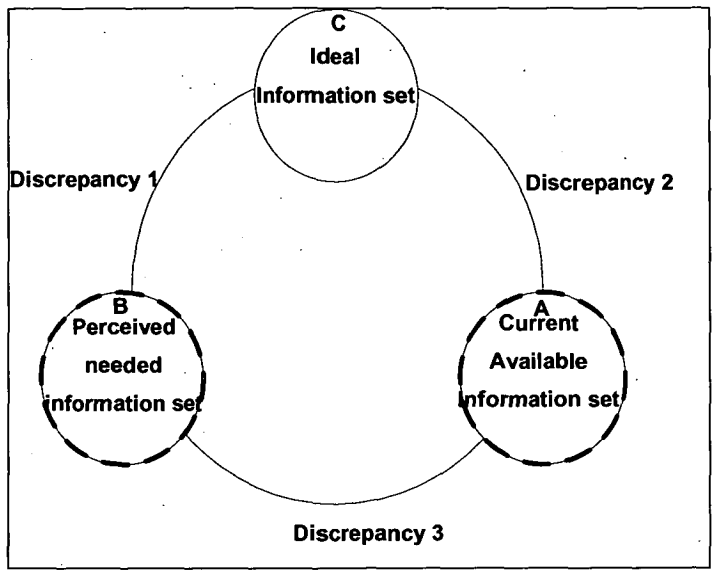
Most of the information systems research lacks theoretical backing in information systems and information management to support the framework of the study. This leads to this study being conducted under a carefully developed conceptual framework comprising of a list of independent and dependent variables suggested to be studied in information and information systems research.

The types of information and the information quality variables were chosen to develop the conceptual framework of this study. These variables will be examined in three aspects which are ideal or best practice suggested by academics and trade organisations literature, the currently available information from the company's enterprise information system and the required information of the information users. The data gathered from the questionnaire will be processed and analysed by the three-ring model (Figure 1.1) in section 1.4.

1.4. Method of study

In this study the information of Thai manufacturing firms will be examined from three perspectives. The first is an identification of ideal or best practice information. This will involve an examination and analysis of the related literature. Next, currently available information from the enterprise information systems of Thai manufacturing companies will be identified and compared to the ideal model of information. These data will be collected in a questionnaire survey of managers in Thai manufacturing companies. Last, the information needs identified by managers will be considered and contrasted with the 'ideal' set and the 'currently available' set of information.

Figure 1.1 Method of Study



Source: generated from literature

The three sets of information are presented in Figure1.1. These are: A, the currently available information set; B, the perceived needed information set; and C, the ideal information set or academics and trade associations suggested information set. These three sets (A, B and C) will be analysed for discrepancies as follows.

Discrepancy 1 is the difference between what the academics and trade associations identify as relevant information for specific tasks and its quality and the information perceived to be needed by managers in Thai manufacturing companies. This will show the gap between best practice characteristics and current practice of managers in Thai manufacturing companies.

Discrepancy 2 is the difference between 'ideal' information needs and 'available' information. This analysis will benchmark the current available information set against the ideal set and examine the gap between the ideal information set and the quality of information provided by the current enterprise information systems.

Discrepancy 3 is the difference between the available information set and the required information set. The analyses of this discrepancy will present the area of improvement required in current enterprise information systems.

1.5. Research Questions and Propositions

The main research question in this study is:

> "Are the enterprise information systems currently adopted by Thai manufacturing companies adequate to meet their information requirements?"

This main research question is reduced to sub-questions in order better to understand this matter.

RQ1a What types of information (reports, labour hours, quality of product, etc.) are provided to Thai managers from their current enterprise information systems?

RQ1b What are the characteristics of information (usefulness, timeliness etc) provided by current enterprise information systems?

Research questions 1a and 1b examine the availability of information from the current enterprise information systems and identify the quality of the information available.

RQ2a In what ways do Thai manufacturers like to use information?

RQ2b What information do Thai managers believe they require?

Research questions 2a and 2b are used to investigate how and why Thai managers use information to undertake specific tasks and to investigate the quality information that Thai managers think they need.

RQ3a What are the ideal qualities of information that should be available to managers of Thai manufacturing companies?

RQ3b Does the information available from the enterprise information systems of Thai manufacturing companies exhibit the characteristics of industry best practice?

Research questions 3a and 3b are aimed at identification of the ideal quality of information from the current EIS (which is found in RQ1 and 1a) and to benchmark it against best practice in academic and trade associations.

1.6. Propositions

In order to relate these questions closely to the model in Figure 1.1 the following propositions have been developed.

Proposition 1: There are gaps between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies.

It is expected that there will not be a match in terms of qualities of information and type of information.

Proposition 2: There are differences between the ideal academic and trade associations suggested information set and the information available from the current enterprise information systems.

The ideal information set and the information available from the current enterprise information systems are expected to be different in terms of nature of information and quality. Many studies have found that information systems tend to mismatch with the user expectations.

Proposition 3: There are differences between the information perceived to be needed by managers in Thai manufacturing companies and the currently available information set.

The information set perceived to be needed by managers in Thai manufacturing companies and the currently available information set available from current enterprise information systems, are expected to be different in both nature of information needed and quality of information.

1.7. Terminology

In this research there are some technical terms that need to be defined to clarify the scope of this study and more discussion of them is provided in Chapter 4.

1.7.1 "Enterprise Information System"

According to TC184/SC5:15704, enterprise is one or more organisations sharing a definite mission, goals, and objectives to offer an output such as a product or service (International Organization for Standardization, 2000).

There is no universally agreed definition for what the term enterprise information system means, although numerous definitions have been suggested. The definitions of an enterprise information system are as follows.

Considine, Razeed, Lee, and Collier (2005:280) define the enterprise information system as:

> "Enterprise information system is information systems software used by businesses to capture their transactions and to produce outputs that are used for planning, decision making and statutory reporting".

Pearlson and Saunders (2001:98) define the enterprise information system as:

> "A comprehensive software package that incorporates all modules needed to run the operations of a business".

Dunn,Cherrington, and Hollander (2005:2) defines "the integrated enterprise information system" as

> "A set of communication channels in a business organization, combined together in such a way as to form one network by which information is gathered and disseminated."

This study adopts the definition of "enterprise information system" from Considine et al., (2005) as the meaning is specific to the objective and function of enterprise information systems that is easy to understand.

1.7.2 "Thai manufacturing companies"

The term Thai manufacturing companies in this study refers to either Thai-owned or Multi-National companies which operate in Thailand and are listed on the Stock Exchange of Thailand. They may produce and sell manufactured products or manufacturing processes. It includes companies that produce agricultural, mining or construction products.

1.7.3 Large manufacturing companies

The definition of large organisations is not officially defined in Thailand. However, there is a definition of small and medium size organisations issued by the Thai government. Therefore, the organisation which does not match the definition of the SME is recognised as the large organisation in this study. The Institute of Small and Medium Enterprise Development provides the definition of SME organisations in manufacturing, as shown in

(Table 1.1) and production organisation means agricultural processing, manufacturing, and mining.

Table 1. 1 Definition of small and medium enterprise

	Small organisation		Medium organisation	
	Total asset	No. Employee	Total asset	No. Employee
Production organisation	< 50 million baht	< 50	< 200 million baht	50-200

Source: Adopted from Institute for Small and Medium Enterprises Development (2008)

So, a Thai large manufacturing company is one where the production organisation is owned and operated in Thailand in the agricultural processing, manufacturing and mining sectors and has total assets of more than 200 million THB and employs more than 200 people.

1.8. Significance of the study

It is generally accepted that managers use information generated within the organisation in their decision-making processes. However, this information may not be adequate due to the complexity of the organisation or the decision, or the lack of appropriate qualitative characteristics of information and the limited types of information available. The nature, characteristics and flows of information aimed at supporting managers in their decision-making may be redesigned as a result of the findings of this research.

As a result of this research management may be able to redesign their reporting models to enable optimisation of the decision-making process and to give priority to the real activities and processes within Thai organisations. It may guide Thai management to a better understanding of the true potential of an organisation and its ability to achieve efficient and/or sustainable results. Moreover, the systems designers may use the findings to design better enterprise information systems.

1.9. The organisation of this thesis

This thesis consists of seven chapters. In Chapter 1 the background to this research, the purpose of the study, the research questions and propositions and the significance of research are presented. Chapter 2 is a review of the relevant literature, divided into three parts, in which information and information system in business, the nature of information required in business decision-making and information quality and its delivery will be

identified. Chapter 3 will focus on the theoretical framework underpinning the research. In Chapter 4 the research method is identified and discussed. Also presented in Chapter 4 are the definitions and descriptions of relevant variables, the study population and the data collection method. Chapter 5 provides the analysis of data from the questionnaire and personal interviews. Chapter 6 provides a discussion and analysis of the results in terms of the research propositions. In the last chapter the conclusions of this study will be presented and the limitations of this research and future research directions will be considered.

Chapter 2

Literature Review

2.0 Introduction

This chapter presents the review of the literature in three parts: information and information systems in business; information required for business decision making; and information quality and the delivery of quality information. In the first part, literature in the area of information and information systems in business is reviewed in four main areas which are: fundamental concept of data; information and information systems; the importance of information in competitive business environment; the importance of information to decision-making; and the situation of information systems in Thai business. In the second part, the nature of information required in business decision making, literature is reviewed to form the big picture of: the task responsibilities of departmental managers; decisions that they have to make; and the types of information suggested as being useful by academics and trade associations. In the third part, literature on information quality is reviewed to provide definitions and an overview of the field.

2.1 Information and information systems in business

Information and information systems in business are studied from many perspectives such as information science, management and information management. In general, information and information systems cannot be studied alone but need to be examined with the context of organisational and technology (Laudon and Laudon, 2002).

2.1.1 Fundamental concepts

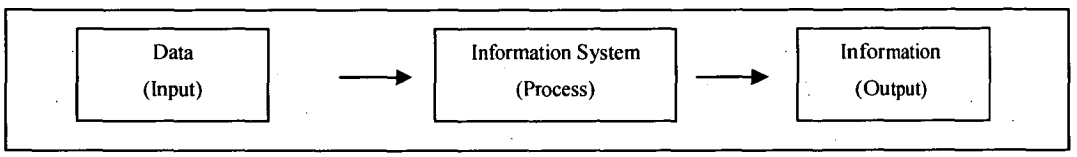
The term "information" is not clearly defined and varies depending on the area of study. The terms data, information and knowledge are often used synonymously. However, academic and professionals in information systems and information management define these terms differently. The term data is defined as the facts that are captured from events or situations. Unlike data, information requires some processes of analysis. Turban, Aronson and Liang (2005: 214-215) give the following commonly accepted view of these terms:

Data. Items about things, events, activities, and transactions are recorded, classified, and stored but not organised to convey any specific meaning. Data items can be numeric, alphanumeric, figures, sounds, or images.

Information. Data that have been organised in a manner that gives them meaning for the recipient. They confirm something the recipient knows, or may have 'surprise' value by revealing something not known.

These definitions can be understood in the view of information system environment in which data are a raw material of the system and information is the product of the information system (Figure 2.1). However, some authors in information systems, information management and information quality use the terms data and information interchangeably.

Figure 2.1 Input-Process-Output



Source: Adopted from Laudon and Laudon (2002)

"An information system can be defined technically as a set of interrelated components that collect (or retrieve), process, store and distribute information to support decision-making, coordination and control in an organization" (Laudon and Laudon, 2002:7).

Information systems can be roughly categorised into two types by the way the information systems are operated. The first is the manual-based information system which is the set of components that work together in a system to collect, process, store and distribute information and the second type is the computer-based information system which means the information system that relies on computer hardware and software for collecting data, processing data and producing the information (Laudon and Laudon, 2002).

2.1.2 The importance of information in the competitive business environment

Information is a valuable business resource which enhances the competitive ability of organisations. Marchand (2000) suggests that management teams have the responsibility to deploy the appropriate types and quality of information so that people can execute their activities effectively. He also adds that the strategic

information alignment framework presents four ways of using information to create business values. Information can be used to assess and respond to risks that occur across the companies' management processes. Using information to reduce costs is to use information as efficiently as possible to achieve the outputs required from business processes and transactions. Value can be added by using information through the products and services offered to customers. Information can help people in organisations to create new ideas, to apply them rapidly and to share information and promote creativity throughout a company.

Wilson (1993) suggests that organisations need relevant, timely and accurate information in order to succeed in global competition. The author also adds that organisations need information about marketing research, quality control, progress of production, budget and costs, design, and sales to compete well in the global market.

2.1.3 The importance of information to decision-making

Information plays several important roles in decision-making. One role of the information is to provide the relevant data which will assist decision makers to make rational decisions and to help managers stay well informed about current situations (Daft, 1997). Wilson (1993) claims that there is a close relationship between information quality and decision quality and it is unusual for managers to make good decisions if they do not have good quality information.

2.1.4 The situation of information systems in Thai business.

Marchand (2000) remarks on the supporting role of information in protecting businesses against their competitors. Currently, Thai businesses operate in a highly competitive environment in both the local and the global environment. In order to achieve their goals, Thai businesses have to prepare themselves to take action and make decisions in a highly competitive environment, by adopting information technologies and systems. The literature suggests a number of Thai organisations have adopted electronic information systems especially the enterprise-wide information systems to manage internal data and provide management information that leads to competitive advantage. For example, 52.2 percent of Thai companies have adopted ERPs (Arunthari, 2005).

The Information and Communications Technologies (ICT) Survey of Thai businesses reports that 79.7 percent of Thai organisations employing more than ten people, use computers in their operations, 55.4 percent of these have internet access and 26.2 percent use web presence to do their business (Korka, 2008).

2.2 Information required for decision making

As outlined before information has to be studied within an organisational and technological context. This study will link the information with decision making tasks in organisations. Daft (1997:8) added that "management is the attainment of organisation goals in an effective and efficient manner through planning, organizing, leading, and controlling organisational resources and he gave the definition of responsibility as the duty to perform the task or activity an employee has been assigned". Typically, managers are assigned authority commensurate with responsibility. Fayol (1949) proposed the unity of direction principle; similar activities in an organisation are grouped together under one manager. In each group, the tasks and responsibilities are delegated to employees or the agents of the organisation. Departmental managers or functional managers are responsible for departments that perform a single functional task and have employees with similar training and skills (Daft, 1997) such as sales, human resources, manufacturing, finance and accounting.

Dixon (1993) added that several department functions are common in any organisation even they may be named differently. The production, marketing, finance, and purchasing are typical functions in organisations.

Managers are positioned in the management level of organisation. Their responsibilities are above the operation level and are involved with the strategic level. Managers within the organisation can be classified into three levels which are top manager, middle managers and operation managers. The levels of management are relevant to the context and complexity of the tasks and responsibilities they have to handle. Top managers are responsible for the entire organisation such as president, chairperson, executive director, chief executive officer and executive vice-president. The responsibilities of top managers are setting organisational goals, defining strategies for achieving them, monitoring and interpreting the external environment and making decisions that affect the entire organisation (Daft, 1997). He added that

middle managers are responsible for implementing the overall strategies and policies with the near future defined by top managers in business units and major departments and the first-line managers are directly responsible for groups of non-management employees and day-to-day goals, the production of goods and services such as supervisor, line manager, section chief and office manager. Purchasing managers are middle managers responsible for policies in purchasing departments.

From this point, the literature about purchasing departments is identified to set up the type of information required. First, the tasks and responsibilities of purchasing department managers will be examined in academic and trade associations' literature (2.2.1). Then the decision issues from tasks and responsibilities will be extracted and the scope of each decision explained (2.2.2). Lastly, the type of information involved in each of decision is presented (2.2.3).

2.2.1.1 Responsibilities and tasks in the purchasing department

Purchasing is one of the common business functions that exists in every organisation, both manufacturing and service organisations in acquiring products and services from outside organisations. Elliott-Shircore and Steele (1985) cited in Quayle (2006:3), stated that

> *Purchasing is the process by which company (or organizations) contracts with third parties to obtain goods and services required to fulfil its business objective in the most timely and cost-effective manner.*

Dobler and Burt (1996) suggest that purchasing departments are the hub of much of a firm's business activity that cuts across all department lines. They add that its work with suppliers, produces the information needed by the finance, material control, and quality assurance groups to perform their duties in a timely and effective manner. Purchasing is an important business function. Much of theliterature about purchasing and supply chain management claims that the performance of purchasing departments contributes to competitive advantage and organisational strategies in several ways (Fearon, 1973; Krause Pagell and Curkovic 2001; Boer, Labro and Morlacchi 2001; Sarkis and Talluri, 2002).

The finished manufacturing product is significantly affected by purchasing departments in terms of cost, quality and delivery (Krause et al., 2001). If purchasing is conducted efficiently, the organisation can save on purchasing costs. At the same

time, purchasing functions also have a direct impact on revenues. Both cost reduction and increasing revenue can lead to higher profits in the organisations (Gadde and Hakansson, 1993; Alexander Hamilton Institute, 1977). Purchasing departments also contribute to product development and product quality improvement as suppliers nowadays tend to work together with their customers to support the research and development (Gadde and Hakansson, 1993; Alexander Hamilton Institute, 1977).
In order to have purchasing department support the strategies of the organisation, the organisation has to make sure that the purchasing department has the ability to perform efficiently. Information is an important management tool to help the purchasing department to achieve good performance to support the whole organisation's strategies. According to the literature the use of information technology tends to reduce the operational burden placed on purchasing (Trent and Monczka, 1998). Management information systems and many information technologies and techniques have been developed specifically to support the tasks of purchasing departments some of these are Material Resource Planning (MRP), Electronic Data Interchange (EDI), Online Auction, Business to Business Electronic Commerce (B2B E-Commerce).
Many academic and professional textbooks in purchasing, supply chain management, production and operation management areas clarify the responsibilities of a purchasing department as follow (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann, Oakland and Lockyer 1992; Dobler and Burt, 1996; Johnston, 1996; Stevenson, 1996; Trent and Monczka, 1998).

2.2.1.1.1 Buying

It is commonly accepted that a main responsibility of a purchasing department is buying or purchasing (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann et al., 1992; Dobler and Burt, 1996; Johnston, 1996; Stevenson, 1996; Trent and Monczka, 1998). Dobler and Burt (1996) divide the buying responsibility into many activities such as coordination with user departments to identify purchase needs, discussions with sales representatives, identification of potential suppliers, negotiations with potential suppliers, analysis of proposals, selection of suppliers, and issue of purchase orders.

Muhlemann et al., (1992) list the responsibilities of the purchasing department, beginning with discussions with sales representatives, examination of catalogues and samples to identify the supplier. However, normally, this process might be conducted by the quality and design departments with the support of the purchasing department to ensure that the source of supply is stable, reliable and able to fulfil the demands made upon it. After that, the quality and quantity of goods and services are specified and the purchasing department has to purchase those goods and services on the most advantageous terms. Once the order had been issued, the activities involve contacting suppliers to ensure goods and service delivery at the right time. In cases of delays in delivery, the purchasing department should warn all concerned about the delay. The verification of invoice against price quotation is performed to prevent the problem of incorrect quantities invoiced or priced which lead to the rejection of the order.
Stevenson (1996) presents the activities and processes of a purchasing department as a cycle which begins with the requisition which is received by the purchasing department. The requisitions include descriptions of the items or material desired, the quantity and quality necessary, desired delivery date, and the requestor of the purchase. In the next step the purchasing department must identify a supplier capable of supplying the desired goods. After supplier selection, the order will be placed. The follow-up of orders is carried out to make sure of on-time delivery. The last activity of this cycle is receiving the order which includes checking for quality and quantity.
A purchasing professional handbook gave more detail in buying responsibility. The literature outlines several types or methods of buying which are ordinary purchase, forward buying and hedging futures market (Hoagland and Tateosian, 1982), capital equipment buying (Flannery, Frank and Carmody, 1982), contracting for service (Black, Huzar and Peters 1982), and construction (Hartwell, 1982). The activity in long-range material planning is administration of contracts and resolution of related problems and maintenance of a variety of purchasing records (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann et al., 1992; Dobler and Burt, 1996; Johnston, 1996; Stevenson, 1996; Trent and Monczka, 1998).
To fulfil the needs and requests on raw material and others products and services that the organisations are unable fulfil by themselves, the needs and requests have to be obtained from external sources which can be defined as buying or procuring. Within

the buying activity, each type of need and request is suggested to indicate the method or types of buying.

Capital equipment generally refers to fixed and long-lived assets. As a result, the process of buying capital equipment is different from the ordinary buying process in that each transaction usually results in separate and extended negotiation (Flannery et al., 1982). This author also states specific characteristics in the nature of capital equipment buying such as consideration of industrial standards, specially customised, unique to buyer's specifications, orders and in some cases, unique in terms of no specifications available, and special terms and conditions. To fulfil the need for capital equipment, the options available are buying new equipment, buying used equipment or leasing the equipment.

Contracting is the buying of services from external organisations. There are four major types of services: professional services; facilities and equipment-related services; personnel-related services; and labour and craft services (Black et al., 1982). The professional services referred to are legal, engineering, architectural, data processing, programming, testing, consulting, employing temporary staff, etc. The examples of facility and equipment-related services are janitorial, equipment maintenance, security, data processing, reproduction. Cafeteria, clothing and vending machines are examples of personnel-related services. Labour and craft services refer to construction. Inbound and outbound shipments are services that could be included in this type of buying.

Construction is another item that organisations may buy in. Hartwell (1982) explains that purchasing construction is based on bidding patterns but it has more detail than the common types of contracts such as fixed-price types and cost-reimbursable or cost-plus-a-fee contracts. To fulfil the needs and requests of construction, acquiring the new construction purchasing, using internal resources to make or to lease are possible methods.

In this study, activities within the buying responsibility are grouped and re-organised within the 3 phases of buying which are pre-order, order placement and post-order phase (Janson and Frey, 1982). This means other responsibilities that relate to buying such as forward buying which some literature suggests not be included in the normal

buying responsibility is presented in buying responsibility such as the receiving, follow-up of an order and long-range material management.

After the order is placed, the responsibilities to take care of the orders shift to the receiving or inventory control functions (Dobler and Burt, 1996). However, they add that the purchasing departments have to be involved again if delivery failures are noticed.

2.2.1.1.2 Study and analysis responsibilities

The second main responsibility of purchasing departments is to conduct studies on purchases, markets and materials in order to get up-to-date information to support their operation (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann et al., 1992; Dobler and Burt, 1996; Johnston, 1996; Stevenson, 1996; Trent and Monczka, 1998). The market, market trends, material, price, and supply sources are the subject of studies as well as developing the new supplier sources and alternative materials and sources (Corvey, Dusen and Hutchison, 1982).

2.2.1.1.3 Inventory management responsibility

Inventory management may be one of the responsibilities of a purchasing department (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann et al., 1992; Dobler and Burt, 1996; Johnston, 1996; Stevenson, 1996; Trent and Monczka, 1998). Most of the activities within inventory management are subject to the policies and standards of inventory. According to Corvey et al., (1982), the activities of inventory management are as follows: developing inventory classification, maintaining minimum stock, establishing economic order levels, maintaining inventory balance, setting up stock and parts number systems, consolidating requirements, avoiding excess stocks and obsolescence, declaring surplus inventory, standardising packages and containers, maintaining property records. The accounting for returnable containers and demurrage charges are included in the inventory management. The purchasing department is also partly responsible for the improvement of inventory management such as inventory turnover.

2.2.1.1.4 Maintain data and information responsibility

During the buying process, the data are recorded and updated (Ammer, 1980; Aljian and Farrell, 1982; Muhlemann et al., 1992; Dobler and Burt, 1996; Johnston, 1996;

Stevenson, 1996; Trent and Monczka, 1998). The purchasing departments are responsible for maintaining data and information such as purchase, price, stock, consumption of stock, supplier performance information, etc.

Jason and Frey (1982) report several benefits of computerised purchasing systems such as elimination of filing and paperwork, saving time and improving communications with other departments. It is the generally accepted that purchasing activities can be performed well by a computer-based system. For example, the computer-based systems in purchasing have the ability to maintain inventory, supplier, and orders records; to compute order quantities; to prepare related documents such as purchase requisitions, quotations purchase orders and operating reports for management (Janson and Frey, 1982; Dobler and Burt, 1996). The recent developments of information technology and communication networks have enhanced the ability of purchasing computer systems such as the generation of automatic follow-up memos, audit of invoice and cheques for payment and Electronic Data Interchange (EDI) communications (Dobler and Burt, 1996).

Purchasing data can be collected and stored in the information systems such as item file (products and services), vendor file and open-order file (Janson and Frey, 1982). The item file contains varied attributes such as item profile, quality, lead time, costs, measurement, ordering policy, historical and forecast usage and inventory (Dobler and Burt, 1996; Janson and Frey, 1982). They suggest that the vendor data generally contains supplier profiles, terms, shipping data, performance data, purchasing history and the purchase order file contains data such as supplier details, quantity of purchase, units' price, shipping data, receiving data, receiving inspection data, invoice and invoice payment data. Dobler and Burt (1996) add that the computer files usually contain the same detailed data and perhaps more than in the manual systems.

The literature in purchasing and material management adds more responsibilities to purchasing which moved from tactical commitment towards the strategic or value-adding tasks (Trent and Monczka, 1998). From the same article, the results of the survey indicate that since the 1990s purchasing departments have increased their participation in international supply management, new product development involvement, commodity futures trading, outbound and inbound transportation, travel

buying, production buying, construction/capital buying, strategic purchase planning and sub-contracting.

Similarly to the academic texts, Robinson et al's (1967) cited in Sheth (1973) study of the integrated framework of three classical organisational buying behaviours the result of which study was supported by Johnston and Lewin (1996), Webster and Watson (2002) and Sheth(1973). Their integrated model confirms that the processes of buying begin with recognition of need and general solution. After the needs are identified, the processes of determination and description of characteristics and quantity are performed. Then, purchasing departments have to search for potential sources, acquire and analyse proposals. Then the processes of evaluating proposals and selecting suppliers are managed. Lastly, activities related to performance and feedback and evaluation are done to complete the buying process.

The review presented above shows that academic textbooks and the literature identify that purchasing departments share almost the same responsibilities (Table 2.1). After reviewing the responsibilities of purchasing departments, it was decided to focus on the buying activities as only they involve continual decision making. The responsibility to conduct market and material studies and long-range material planning relate more to documentation and learning processes and in many organisations inventory management is a separate function. The decisions which have to be made in buying activities are listed in the following sections.

Table 2.1 The summary of responsibilities and tasks of purchasing departments

Responsibilities and tasks of purchasing departments	Ammer (1980)	Aljian and Farrell, (1982)	Dobler and Burt (1996)	Muhleman, el at., (1992)	Stevenson (1996)	Trent and Monczka (1998)	Johnston and Lewin (1996)
Buying which contains sub-tasks as follow: Identify purchases needs Discussion with sales representatives Identification of potential suppliers Conducts of marketing studies Negotiation with potential suppliers Analysis of suppliers proposal Selection of supplier Issues of purchase orders	√	√	√	√	√	√	√
Receiving order or Reject order	√	√	√	√	√		
Follow-up order to make sure on-time delivery	√	√	√	√	√		
Administration of contracts and resolution related problem	√	√	√	√	√	√	
Organise bidding	√	√	√		√		
Outbound and inbound transportation	√	√	√			√	
Construction/capital buying	√	√	√			√	
Maintenances of variety of purchasing records	√	√	√	√	√	√	
Provide information about purchase to other departments	√	√	√	√	√		
Purchasing research, studies and analyses	√	√	√	√	√	√	√
Develop and Managing buying long-range material plan such as forwarding, commodity future market	√	√	√		√	√	
Inventory Management	√	√	√				
Manage purchasing policy	√	√	√		√	√	
International supply management	√	√	√			√	
Monitor supplier performance	√	√	√		√		√
New product development involvement		√	√			√	
General management responsibilities	√	√	√				

Source: generated from literatures

2.2.2 Decisions purchasing department managers have to make

Decision-making is a process of thought and action that leads to a decision. Dixon (1993:33) states that:

> *Decision-making lies at the heart of management as managers spend their time choosing between alternative courses of action on the basis of the information available to them at the time; in other words, making decisions .*

Decisions have close linkages with management tasks. In the next section, the responsibilities and tasks of a purchasing department suggested by the academic literature and trade associations are presented in order to gain a better understanding about the nature of a purchasing department's management and the tasks and responsibilities. After that, this section will be used to identify the possible information needed by a purchasing department. This will help to identify the types of information items in the questionnaire for the second survey.

A decision is an event about which the manager must make a choice and take action (Daft, 1997).From this statement, making decisions is an important task that all managers have to perform and it has a close relationship with information. Dixon (1993) also adds that any decisions made can only be as good as the information on which they are based. Robbins and Barnwell (1998) add that every manager in an organisation has responsibility to make decisions. They also mention that decisions of managers are all about goals, budget allocations, personnel, the way in which work is to be done and ways to improve his or her unit's effectiveness.

In this section, the decision topics in a purchasing department are classified within the three main groups of responsibilities of a purchasing department presented in the previous section.

Decisions in the buying responsibility

Many decisions' topics in buying responsibility are abundant in the pre-order phase but less in the order placement phase.

2.2.2.1.1 Decisions in the pre-order phase

The pre-order phase is the period after the need to buy is identified and before an order is placed. Many decisions need to be made in this phase. After the purchase requisitions from users/departments have been delivered, a decision to buy has to be made. The criteria in buying decisions are the materials or supplies are not available in stock and the items are necessary according to purchasing plan and budget. The decision to buy is a decision to be made in the purchasing department (Kudrna, 1945).

The topics of decisions in the pre-order phase are type of purchase, the specification of an order and sources of purchase.

2.2.2.1.1.1 Type of purchase

Buying can be performed in several methods as mentioned in a previous section. The purchasing departments have responsibilities to choose the proper method suitable to each order. The identification of buying type decisions is to select the method to deal with the order. Several types of buying are suggested in the literature such as, ordinary buying and special purchase which are forward buying and hedging the futures market, capital equipment buying, contracting for services, and purchasing construction. The type of purchase selected will lead to specific processes of purchase.

2.2.2.1.1.2 Set-up the specification of order

Specification of order in purchasing is defined as the detailed descriptions of the materials, parts, and components to be used in making a product (Dobler and Burt, 1996). The specifications contain quality, quantity, delivery time, price and source of item to be purchased (Corvey et al., 1982; Dobler and Burt, 1996).

1. Quality

Quality is a basic factor and first consideration in any purchasing decision (Berry, 1973; Dobler and Burt, 1996). Dobler and Burt (1996:161) state

> *In industrial and institutional purchasing, quality is related to suitability and cost (not price), rather than to intrinsic excellence. The best quality is that which can be purchased at the lowest cost to fulfil the need or satisfy the intended function for which the material is being purchased.*

This means the specification of purchasing directly affects the quality and performance of the item purchased and the value for money paid. Blue, Manthos, Black, Bishop, Morton, Levy and Vyenielo (1982) argue that the specification of the order is not limited to quality of items such as dimension, weight and performance characteristics but include accurately specifying the requirements. They (1982:9-2) state that

> *The quality of product is a measure of the degree to which the product meets the requirements of the immediate purchaser, the intermediate fabricator or assembler, the distributor, and the ultimate consumer of the end product.*

2. Price of purchase

The price of purchase specification is not only defined as the price of an item but it includes the transportation costs, receiving and inspection costs, incremental purchasing costs and any follow-on costs related to quality and service (Dobler and Burt, 1996). The price specification is not necessarily the lowest price, as the lowest price may not provide the proper quality for the intended purpose or it may not secure the proper service from suppliers (Corvey et al., 1982). Therefore, the price of the purchase has to be combined with the quality features of the product and the service aspects of the relationship with the supplier.

3. Amount to make an order

The amount specification is a complicated decision because the amount of buying affects the unit cost as a large order might get a cheaper price than a smaller order. At the same time, the size of the order also affects the shortage of items and production schedules and the splitting and combination of orders are reported to be a decision topic in quantity specification.

4. Time to place order

Timing decisions are influenced by a number of factors, including the type of market in which the purchase is to be made (Dobler and Burt, 1996). The authors add that the timing is not a critical matter from either point of view when the purchase is made in a stable market but increases its importance in an unstable market. Placing the order is a critical decision, because timing affects the costs and the shortage of the items. The

orders have to be placed to meet the demand of the users/departments requests (Corvey et al., 1982).

5. Sources or supplier

The supplier selection is to select a vendor who has the capabilities and know-how able to fulfil the specifications of the order (Blue et al., 1982; Dobler and Burt, 1996). The authors add that selection of supplier may be made by a specific investigation involving one supplier and a single transaction, by choice from an established list, by a routine selection based on experience and by use of a well-established, well-known company. Dobler and Burt (1996:240) cited the definition of the best supplier given by Professor Wilbur England of Harvard University that

> *A good supplier is one who is at all time honest and fair in his dealing with the customers, his own employees, and himself; who has adequate plant facilities, and know-how so as to be able to provide materials which meet the purchaser's specifications, in the quantities required, and at the time promised; whose financial position is sound; whose prices are reasonable both to the buyer and to himself; whose management policies are progressive; who is alert to the need for continued improvement in both his products and his manufacturing processes; and who realizes, in the last analysis, his own interests are best served when he best serves his customers.*

The supplier selection can be performed in two ways, which are, self-studies of potential suppliers and the bidding process. The supplier selection is an important responsibility of the purchasing department (Weber, Current and Benton 1991). The supplier selection responsibility involves many tasks and activities such as identification of potential suppliers and negotiations with the potential suppliers.

The supplier selection decisions are defined as the analysis of information assembled regarding the alternatives available to the buyer (Inman and Schoenberger, 1982). In general, the purchasing departments have to perform the supplier study and contact the suppliers. The selection of a supplier from bids requires more processes to deal with the bidding process.

6. Number of suppliers decision

In some organisations, the supplier selection might go for multi-supplier choice which provides advantages in being able to keep all genuinely interested (Inman and Schoenberger, 1982). The author adds that multiple sources provide a broader technical base to the buyer as suppliers seek to increase their share of available business and to make a multiple sources decisions, the organisations must decide how to divide the business or order; the ideal proportion of 50:50 split is suggested. The three basic factors in any purchase decision between alternate suppliers are the quality, the service, and the price, respectively (Corvey et al., 1982).

Organisations are able to have one or more suppliers. The literature argues that the single source method is favoured when it: results in significantly lower freight cost; requires special tooling and excessive cost which happens with more than one supplier; reduces total system inventory; improves interdependency and risk sharing result, is in critical time to market (Dobler and Burt, 1996). In contrast, multiple sourcing may be appropriate to protect organisations during times of shortage, strikes and other emergencies; to maintain competition and provide a back-up source; to meet local content requirement for international manufacturing locations; to meet customer's volume requirements; to avoid complacency on the part of a single-source supplier; when the customer is a small player in the market for specific item; when the technology path is uncertain in an area where suppliers tend to leapfrog each other technologically.

7. Local, national or international sources decisions

Another decision related to selection of suppliers is to decide whether to buy from local sources, national sources or international sources. Each source of goods and services has benefits and drawbacks as follows.

Dobler and Burt (1996:225) state that

> *Two considerations are involved when deciding to buy locally or nationally. First, large-dollar purchases should be placed at sources as close to the manufacturer as possible to obtain optimum prices and discounts. Second, small- and medium-dollar purchases should be placed with local sources when price differentials are small or when such action is necessary to keep materials physically available in the immediate area.*

The advantages of buying locally are timing and lower costs such as closer cooperation between buyer and seller in geographical proximity, reduce the factor in delayed delivery from transport system, shorter lead time, lower costs and social responsibilities to community (Dobler and Burt, 1996). They argue that buying from national sources has the following advantages: meet the economies of scale, in some situations be more efficient in the aspects of higher quality, better service, superior technical assistance, greater production capacity and lower price. They remark that a problem in buying goods and services from foreign origin is the wide variability among the producers in characteristics such as quality, service, and dependability. The authors also note the six common reasons for purchasing goods and services from international sources which are quality, timeliness, cost, product and process technologies, broadening the supply base and counter trade.

8. Manufacturer-distributor decisions

The decisions on whether to buy from a manufacturer or distributor impact on supplier selection (Dobler and Burt, 1996). The major consideration is the quantity of order which suggests that the smaller order goes to distributors and the larger ones and quality customised go to manufacturers. In this decision, the main consideration is the distributor's capabilities and services, not its location.

2.2.2.1.2 Decision-making in order-placement phase

In the order-placement phase, only the content of the purchase order terms and specification are relevant. After an order is placed, the affirmation of the purchase order or acknowledgement of purchase order is performed once the supplier receives the purchase order and sends the document to reconfirm the order.

2.2.2.1.3 Decision-making in the post-order phase

Decisions have to be made in the post-order phase when there has been a failure in the delivery system (Berry, 1973). The author presented the possible options in the event of rejection, as follows. The first option is informing the supplier and returning the goods at the supplier's expense. The second option is returning for replacement by using a memorandum invoice or credit memo pending receipt of usable material. The third option is calling for a technical negotiation to work out a solution and avoid shipping expense and loss of time. The last option is securing a price adjustment if goods are usable but sub-standard. The cancellation of orders is suggested by Dobler and Burt (1996).There is also the option of suing the supplier for damages.

In the next section, types of information used in buying decisions are reviewed and presented.

2.2.3 Types of information and decision-making

The literature on Management Information Systems states that an information system has to provide at least the information needed by the user in the context of a specific problem that that user faces (Mason and Mitroff, 1973). The authors also add that each information user in organisations has their own needs and types of information and the types of information needed by one will not be the types of information needed by another. Al-Hakim (2007) suggests that decision makers in the information age have access to much data but more than ever make decisions with sub-optimal data because they are starving for information. Robbins and Barnwell (1998) suggest the same idea that the scare resource is the processing capacity to attend to information not the data. In order to identify the information required, problems or decision topics related to the information have to be declared first.

In a purchasing department, several types of information are useful to support a particular decision issue. The information used in purchasing departments comes from both internal and external organisational sources. The major external source is from suppliers, and the external data are also related to the past experience with the item, lead time and general information about each supplier.

2.2.3.1 Types of information suggested in buying decisions

The types of information in buying decisions from the literature review process are presented in each type of buying.

2.2.3.1.1 Types of information suggested in the pre-order decision

2.2.3.1.1.1. Selection of type of buying

In ordinary buying material decision, an extensive list of factors influences in the decision are material specifications, availability of material, and sources of material/ supplier.

In forward buying, several types of information are important to decision-making such as price, supply and demand, technology and discovery, number and location of suppliers, labour conditions, transportation, government actions, costs of possession and international events (Hoagland and Tateosian, 1982). The authors also add that the qualities of this information should be accuracy and relevance. They suggest that the forecast data and information suggested comes from purchasing survey, forecasting business trends, and calculation of change index to forecast the trend over time. The authors described forward buying as the purchase of materials, products, and/or services for future delivery, use, and/or performance under agreed conditions such as price determination and the time interval of forward buying is varying from a very short period to many years. The main reasons for forward buying are to: ensure continuity of supply, establish a future price, and safeguard the standard and quality of an item and the main reasons for hedging the futures market are to secure material from rare situations on a deferred price basis or to buy forward at a fixed price.

2.2.3.1.1.2 Set-up the specification of order

Information about products and services that need to be purchased, quality and quantity of products and service, source of products and service and desired delivery date.

1. Quality

Types of information important to quality specification decision are industry standard, manufacturer's standards, brand name, standard grade, part drawing, part specification, tolerance, finishes, material specification, manufacturing process specification, quality control system requirements, acceptance tests, packaging specifications, performance

specification, warranty provisions, distribution provisions, field service requirements, and resale requirements (Dobler and Burt, 1996).

2. Price

Price information is important to all purchasing departments' responsibilities, as the basic responsibilities of the departments are to obtain the greatest value at the lowest cost (Frye, Adams and Fratilla 1982). They defined price as the money value set by the seller for a lot or units of goods and services. Another type of information useful in the pricing consideration is discounts on offer such as trade discounts, quantity discounts, season discounts, and cash discounts (Dobler and Burt, 1996).

Product price, payment terms, legal restrictions on pricing, transportation costs taxes affecting pricing, insurance requirements are types of price information.

Dobler and Burt (1996) determine the seven considerations of the decision to be made. Cost considerations are the main issue in this decision. The costs related to make a decision are material cost, direct labour cost, quality-related costs, inventory management costs, and incremental cost: factory overhead, managerial, purchasing and cost of capital. The price contains many types of information such as transportation cost (Dobler and Burt, 1996), items' prices (Frye et al., 1982; Dobler and Burt, 1996), payment terms (Frye et al., 1982), discount (Frye et al., 1982), receiving and inspection costs (Dobler and Burt, 1996), incremental purchasing costs (Dobler and Burt, 1996), any follow-on costs related to quality and service (Dobler and Burt, 1996).

3. Amount to make an order

The types of information useful in order quantity comprise quantity usage rate, lead time, safety stock requirement, long-term requirements, transportability and chronic short supply (Dobler and Burt, 1996). Several types of discounts such as quantity discounts, and seasonal discounts are also a type of information need to be used in amount of order decision.

4. Select supplier decision

In supplier selection decisions, the information needs are information about supplier. The types of information about supplier used in this process are products and service

available, price offers, quantity of products and services available, quality of products and services, delivery time and profile of supplier. The profile of the supplier contains the type of information of supplier itself such as name, location, after sale service offer, history of performance with the organisation, flexibility, value-added offer, and relationship with organisation. The types of information used in supplier selection in the bidding process are management capability, technical capability, manufacturing capability, labour-management relations, past performance, financial strength, ethics of supplier. Dobler and Burt (1996) informed about the factors used in selecting the source or supplier which are capabilities of suppliers, service, prices, timing, technical factors and quality. The authors remark on the capabilities of suppliers in the aspects of managerial, financial and technical.

The information needed in capital equipment buying is richer than ordinary buying. Performance guarantees, reference to payment, installation and initial operating service, cancellation clauses and references are suggested as being information needed to be considered in capital equipment buying (Flannery et al., 1982). It was also suggested in a survey mentioned in the same article that primary considerations were: reliability of the supplier, cooperation and ability to provide close liaison before and after delivery, low prices, quick repair service and availability of replacement parts and past services rendered were satisfactory. The bidding package of purchasing construction was suggested to consist of instructions to bidders, general conditions, specific conditions, technical specifications and drawings.

Information about quantity, availability, distribution and service of supplier are used in evaluating suppliers. Some examples of service information of supplier are delivery performance, response to inquiries and prompt submission of data (Inman and Schoenberger, 1982).

2.2.3.1.2 Type of information suggested in the order placement

The types of information used in order placement are supplier detail, item specification such as item's detail, quality, quantity, delivery date and source.

2.2.3.1.3 Type of information suggested in the post-order phase

As mentioned in the post-order phase decision section the decisions in this phase occur in case of failure in deliveries. The literature mentions that it is important that the purchasing department gets the rejection notice promptly with full information for cause of rejection (Blue et al., 1982). The vendor should have full information at once so that the vendor can take necessary steps to replace the defective shipment with proper parts or material which will meet the purchase quality specification.

2.3 Information quality and delivery of quality information

The information quality issue has become popular in the last two decades. Information quality is the focus of study in many disciplines such as information systems, information management, and Concurrent Engineering (CE). The major concern of all disciplines about information quality is focused in the qualitative characteristics of information. This is because the majority of organisations in both government and business are operating on information systems environments nowadays. An important role of data and information is in running business and providing direction for the decision-making processes in organisations.

The evidence shows that many information systems could not deliver the information and fulfil the needs of their users. For example, The Report to President 2005 of Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction (Department Of Defense, 2005:45) stated that:

> *The National Intelligence Estimate or the NIE of the United States assessed that Iraq had reconstituted its nuclear weapons program and could assemble a device by the end of the decade; that Iraq had biological weapons and mobile facilities for producing biological warfare (BW) agent; that Iraq had both renewed production of chemical weapons, and probably had chemical weapons stockpiles of up to 500 metric tons; and that Iraq was developing unmanned aerial vehicles (UAVs) probably intended to deliver BW agent. These assessments were all wrong.*

The same report mentioned the sources of this problem are because of the agent's lack of reliable data and timeliness to produce the information. Al-Hakim (2007) adds that this

situation presents the problem in information qualities in the dimensions of timeliness, free-of-error, completeness and coherency.

2.3.1 Definition of Information Quality

There is no universal definition of information quality. The literature on information quality suggests many meanings. However, there are two main aspects of quality of information that can be derived from the literature: quality of information as consumers' aspect; and quality of data and information as product or service aspect (Ge and Helfert, 2007). In the information consumers' aspect, information quality is defined as the fit between the information itself and the needs of it users (Lesca and Lesca, 1995; Dvir and Evans, 1996; English, 1996b; Kahn, Strong and Wang, 1998:2002; Wang and Strong, 1996; Huang, Lee and Wang, 1999). While in the data and information as product or service aspect, the quality of information is defined as the quality of information product or information service to meet the specific requirements such as accuracy, timeliness, and completeness (Gerke, 1997; Seddon, 1997; Eppler and Wittig, 2000).

Even the meanings of data and information are defined differently. Some authors in information quality use the terms data quality and information quality interchangeably (Al-Hakim, 2007). The term data quality is used widely in measuring the quality of data itself in the database, and some data management information systems such as data mining and data warehousing. The term information quality is used in measuring the quality of the information product or information service from the information system. However, many researchers claim that these definitions of information quality lack theoretical backup (Hill, 2004; Hu and Feng, 2005b; Price and Shanks, 2005). Hu and Feng (2005b) define data and information quality in the information-theoretic perspective. They state that:

> *Data quality is the intrinsic quality of data (a type of information bearer) itself and information quality is the degree to which the information is representative and to which the information can be perceived and accessed (p: 7).*

Information quality can help improve the quality of information systems and improve the quality of decision-making. This is because improvement of information quality can lead to improvement of information system development and fulfil the need of information

system users in the dimension of quality. To design better quality information, it is necessary to understand what quality of information means and how it is measured. The next sections report existing research in the information quality area, existing information quality models and the quality dimensions suggested in information quality models.

2.3.2 Existing Research in Information Quality

Researches in the information quality field were conducted for different purposes and by different methods. They can be categorised into four major categories by research approaches: empirical, intuitive, literature based and theoretical (Price and Shanks, 2005). In the next section, IQ dimensions and measures suggested from the academic literature and trade associations and their definitions are provided. Then the literature in the empirical research related to the IQ frameworks development and their framework details are presented. Last, the literature based on the use of IQ frameworks in assessing the information quality in various industries and organisations is provided.

2.3.2.1 IQ dimensions and IQ measures from the literature

Al-Hakim (2007) states that the term of information quality dimensions refers to issues that are important to information consumers. Information quality has to be understood in multi-dimensional terms (Hu and Feng 2005a; Holmes, 1996). Kahn et al., (1998) present the IQ dimensions in four categories. The four IQ dimensions categories are contextual, intrinsic, accessibility and representation. This set of IQ dimensions is adopted widely in the literature. However, there is no universal standard of IQ dimensions.

This means that organisations have to use more than one information quality dimension to measure the quality of their information or data. Many sets or frameworks of information quality are suggested by the academic literature and trade associations. Epper and Wittig (2000) reviewed the literature on information quality studies between 1989 and 1999. They identified 20 information quality model frameworks, seven definitions of information quality in the literature during that period and evaluated seven frameworks in the characteristics of information quality view. They summarised the common elements of seven frameworks that all frameworks include a time dimension or timeliness as an information quality dimension. Five out of the seven frameworks have

accessibility and relevancy characteristics as information quality dimensions. Four out of the seven frameworks use objectivity and completeness as information quality criteria. Three of the seven frameworks use accuracy and consistency as information quality criteria. In terms of general features of the frameworks, they claim that the majority of frameworks they studied are context-specific rather than generic and widely applicable. Many dimensions of information quality are presented in the literature. Oehlmann, Thoben and Weber (1997) list completeness, accessibility, legal aspects, reusability, and compatibility as the characteristics of information in the second process of formal interaction analysis methodology in their study.

Rolph and Bartram (1994) used a questionnaire to discover the information quality required by managers and professionals in the United Kingdom. The information quality was deconstructed into eight criteria: accuracy, reliability, presentation, timeliness, completeness and information highlights main issues, relevance and usable format. Wilson (1993) adds that information for internal use is useful to decision-making when it has relevance, completeness, accuracy, clarity and timeliness qualitative characteristics. It has a direct bearing on the organisation's ability to respond to market needs. Daft (1997) adds that information that contains accuracy and timeliness qualities is necessary for controlling and management purposes.

2.3.2.2 IQ measures suggested from trade associations

Many trade associations are concerned about information quality issues and they suggest that the information quality dimensions should be applied to make information useful. The International Accounting Standards Board (IASB) suggested a set of qualitative characteristics that make information in financial statements useful as a framework for the preparation and presentation of financial statements. The framework identifies four principal qualitative characteristics: understandability, relevance, reliability and comparability (CPA Australia, 2005).

The Department of Defense (DoD) of the United States of America is concerned about data and information quality as well. It introduced guidelines in data and information quality for all government organisations of the United States of America (Department Of Defense, 2003). DoD Total Data Quality Management (DoD TDQM) is a set of data

quality management guidelines (Management Control and Financial Studies Division, 2001).This framework focuses on the problems and issues that afflict the creation, management and use of data in organisations to support database migration, promote the use of data standard and improve databases conformance to business rules. It had been developed upon the concept of Total Quality Management (TQM) which is a set of management practices to help companies increase their quality and productivity. TDQM manages information as a product of the information system and applies the philosophy of TQM to control the quality of information from the information systems. The core set of IQ requirements are clarity accuracy, completeness, consistency, timeliness, uniqueness and validity of this framework. The definition of each data quality characteristics is shown in Table 2.2.

Table 2.2 DoD core set of Data Quality Requirements.

Data quality	Characteristics description
Accuracy	A quality of that which is free of error. A qualitative assessment of freedom from error with a high assessment corresponding to small error.
Completeness	Completeness is the degree to which values are present in the attribute that require them.
Consistency	Consistency is a measure of the degree to which a set of data satisfies a set of constraints.
Timeliness	As a synonym for currency, timeliness represents the degree to which specifies data values are up to date.
Uniqueness	The state of being the only of its kind. Being without an equal or equivalent.
Validity	The quality of data that is founded on an adequate system of classification and is rigorous enough to compel acceptance.

Source: Adopted from (Management Control and Financial Studies Division, 2001)

On the other hand, the DoD Information quality guidelines suggest only 3 quality dimensions as a basic standard of quality which are objectivity, utility, and integrity (Department Of Defense, 2003).

> *Utility refers to the usefulness of the information to intended users, including the public. Objectivity focuses on whether the disseminated information is being presented in an accurate, clear, complete and unbiased manner and as a matter of substance, are accurate, reliable and unbiased. Integrity refers to security, the protection of information from unauthorised access or revision to ensure that the information is not compromised through corruption or falsification (Department Of Defense, 2003:3).*

However, DoD also comment that standards of quality are appropriate to the nature and timeliness of the information. These guidelines are generic in order to apply them to a variety of media, printer, electronic or other forms of publication.

The Southern California Online Users Group (SCOUG) established the basic criteria of quality and value in information products that are used to judge database performance in ten broad categories, as follows; consistency, coverage and scope, timeliness, accuracy, ease of use, integration, output, documentation, customer support and training, and value-to-cost ratio (Becker,2001).

The National Institution of Standards and Technology provided the Baldrige National Quality Program. Within the Baldrige National Quality Program, the fourth category of the Baldrige criteria consists of data, information and knowledge asset and how it manages its information technology in organisations (Baldrige National Quality Program, 2008). These criteria are contained in four criteria which are accuracy, information integrity and reliability, timely information, and security and confidentiality of information.

The ISO 9000 series of the International Organization for Standardization (ISO) suggests a set of information quality characteristics which are timeliness, accessibility, security and availability (Jomjunyong, 2002).

2.3.2.3 Definition of IQ measures

Accuracy is the most used information quality criterion. Accuracy has been linked to correct, reliable and certified free of error and represents a real-world state similar to that which should have been represented (Wang and Strong, 1996).

Security has been linked to maintenance of information security (Wang and Strong, 1996). Security quality of information was applied to the information systems. The security of information system can be grouped in two aspects: the logical aspect to deal with the data and information in the system; and the physical aspect to deal with the physical risks of the system from the failures and natural disasters.

Accessibility of information is defined as the ability to obtain when needed. Accessibility has been linked to availability or easily and quickly retrievable (Kahn et al., 2002).

Timeliness is close to accessible quality in terms of concerning time but the timeliness is dealing with the current of data and information. Timeliness has been linked to the delay between a change of the real-world state and the resulting modification of the information

system state (Wang and Strong, 1996) to be sufficiently up-to-date for the task at hand (Kahn et al., 2002; Wang and Strong, 1996).

Completeness has been referred to represent every meaningful state of the represented real world system (Wang and Strong, 1996); the extent to which information is not missing and is of sufficient breadth and depth for the task at hand (Kahn et al., 2002; Wang and Strong, 1996).

Reliability has been linked to conveying the right information (Wang and Strong, 1996).

2.3.2.4 Information quality frameworks

Much research has been done in developing data and information quality frameworks (Ballou and Pazer, 1985; Wang, Storey and Firth, 1995; English, 1996b; Wang and Strong, 1996; Eppler and Wittig, 2000; Lee, Strong, Kahn and Wang, 2002; Gendron and Shanks, 2003; Kahn et al., 2002). Since the 1990s, researchers in information systems, information management and computer engineering areas have introduced many frameworks, models and methodologies to measure the data quality and information quality. Those frameworks and methodologies are created to measure the quality of data and information in different environments such as database environment, information system environment, data warehousing environment and the World Wide Web (Hu and Feng, 2005a).Typically, the common components of the information quality framework are a set of quality dimensions or criteria and their definitions. In some frameworks, the quality criteria are grouped under the categories with specific definition.

The development of information quality frameworks can be described in terms of four steps (Price and Shanks, 2005). First, information quality categories are defined to cover the objectives of information product quality and subjective information service quality. In the second step, the derivation approach is defined and selected to use for deriving criteria in each category based directly on the definition of that category. The third is involved with derivation and definition of quality criteria. In the fourth step, the set of quality criteria is classified into categories

In the 1990s, most information quality approaches were introduced for business information systems and databases such as Total Data Quality Management (TDQM) of MIT(Massachusetts Institute of Technology in Boston), AIQM methodology for

information quality and benchmarking of Lee et al.,(2002) which was developed upon the Total Quality Management (TQM) concept. The quality dimensions in TQM concept are focused on: customer satisfaction; well defined responsibility and manage and improve product process. Dvir and Evans (1996) focus their information quality study on the information customers' satisfaction or customer needs.

English (1996b) provides the cost of non-quality information, principle of IQ, and benefit of quality information. The author also defines information quality as consistently meeting customer's expectation which based on the TQM concept.

Dvir and Evans (1996) proposed a Total Quality Management (TQM) based framework for IQ improvement. This framework employs six TQM concepts, namely, Customer Focus, Leadership, Teamwork, Continuous Improvement, Measurement and Benchmarking. They used the case study method in studying the six concepts. They proposed that the methodology be named InfoQual to facilitate the PLAN and CHECK phases of an IQ improvement project. Its goal is to enable superior completion of the customers IQ needs and expectations. InfoQual is based on the TQM framework and uses specific tools; QFD (Quality Function Deployment), IQ dimensions and metrics database, and IQ metrics graphic. QFD is used to translate customer needs into metrics. IQ dimensions and metrics database are used to preserve and reuse experience gained during the improvement process. IQ metrics graphic is a methodology designed to facilitate the manipulation of IQ dimensions in the improvement process.

Dvir and Evans (1996) add that InfoQual methodology is designed to be integrated into common and existing operational approaches to information systems specifications. The next phase of their research will test the practicality of InfoQual in real-life implementation.

Many studies consider data or information as a type of product or service which is considered as output of an information system and use the analogy between data and products to develop measurement models for data and information quality (Kahn et al., 1998; Lee et al., 2002).

Kahn et al., (1998) introduce the Product and Service Performance/Information Quality model (PSP/IQ model) (Figure 2.2). This model is used in assessing how well an

organisation develops information products and delivers information service to consumers (Kahn et al., 1998). They proposed the essential dimensions of IQ for delivering high quality information (Figure 2.3) and mapped these dimensions into PSP/IQ grids. The Product and Service Performance for Information Quality Model (PSP/IQ model) is explained in the 2x2 grid model as the product quality aspect of information addresses the tangible measures of accuracy, completeness, and free-of-errors, and the service quality aspect of information quality addresses the intangible measures of ease of manipulation, security, and accessibility of the information to consumers. "Conforms to specifications" captures the goal of information producers and IS professionals. "Meets or exceeds consumer expectations" captures the view that information must be useful to the tasks of information consumers. The four grids are named: Sound, Dependable, Useful and Usable information and are categorised according to whether the researcher defines information as product or service.

Figure 2.2 the PSP/IQ model

	Conforms to specifications	Meets or exceeds consumer expectations
Product Quality	(Sound information) IQ dimensions Free-of-error Concise representation Completeness Consistent representation	(Useful information) IQ dimensions Appropriate amount Relevancy Understandability Interpretability Objective
Service Quality	(Dependable Information) IQ dimensions Timeliness Security	(Usable information) IQ dimensions Believability Accessibility Ease of manipulation Reputation Value-Added

Source: Adopted from (Kahn et al., 1998)

Figure 2.3 Dimensions of information quality

Dimensions	Definitions
Accessibility	The extent to which information is available, or easily and quickly retrievable.
Appropriate amount of information	The extent to which the volume of information is appropriate for the task at hand.
Believability	The extent to which information is regarded as true and credible.
Completeness	The extent to which information is not missing and is of sufficient breadth and depth for the task at hand.
Concise representation	The extent to which information is compactly represented.
Consistent representation	The extent to which information is presented in the same format.
Ease of manipulation	The extent to which information is easy to manipulated and apply to different tasks.
Free-of-error	The extent to which information is correct and reliable.
Interpretability	The extent to which information is in appropriate languages, symbols, and units, and the definitions are clear.
Objective	The extent to which information is unbiased, unprejudiced, and impartial.
Relevancy	The extent to which information is applicable and helpful for the task at hand.
Reputation	The extent to which information is highly regarded in terms of its source or content.
Security	The extent to which information is restricted appropriately to maintain its security.
Timeliness	The extent to which information is sufficiently up-to-date for the task at hand.
Understandability	The extent to which information is easily comprehended.
Value-Added	The extent to which information is beneficial and provides advantages from its use.

Source: Adopted from (Kahn et al., 1998)

The PSP/IQ model provided only the information quality dimensions and their definitions and quality categories. This led to Lee et al., (2002) developing a methodology for assessment and benchmarking information quality and named it AIMQ methodology which could be claimed as the next step of PSP/IQ. This methodology is developed upon the PSP/IQ model by presenting a set of information dimensions that cover aspects of information quality that are important to information consumers with small changes in quality dimension in two categories on the original PSP/IQ model.

The AIMQ methodology consists of three components which are the PSP/IQ model, Information Quality Assessment (IQA) instrument, and the Information Quality (IQ) Gap analysis techniques. The PSP/IQ model was adopted from the study by Kahn et al., (1998) with a minor change in the model (Figure 2.4). In the process of development of the IQA instrument, a set of information quality criteria was developed under the standard methods for questionnaire development and testing which included the process of developing, reviewing by IQ researchers, which added and revised the set of 15 information quality dimensions from the PSP/IQ model. At the beginning the 12-20 items for each IQ dimensions were developed and at the end of the process an initial set of eight items per IQ dimensions was reached. The IQA instrument was assessed for reliability in a pilot study. The results were used to eliminate items leading to a total of 65 items to assess IQ or four to five items per dimension. The 65 IQ dimensions were contained in

the final questionnaire used in IQ assessment in organisations using the questionnaire. The IQ Gap analysis techniques are a set of algorithms for analysing and comparing the IQAs from the IQA instrument and the PSP/IQ model in order to benchmark the quality of an organisation's IQ and to focus on improvement activities. The Information Quality (IQ) Gap analysis techniques provides two gap analysis techniques which are: IQ Benchmark Gaps, used to assess an organisation's IQ against a benchmark; and IQ Role Gaps and to identify IQ problem is used to compare the IQ assessments from respondents in different organisational roles, information system professionals, and information consumers. Lee et al., (2002) claim that the AIMQ forms a basis for information quality assessment and benchmarking. They claim the results of the techniques are useful for determining the best area for information quality improvement activities.

Figure 2.4 The PSP/IQ model in AIQM framework

	Conforms to specifications	Meets or exceeds consumer expectations
Product Quality	(Sound information) IQ dimensions Free-of-error Concise representation Completeness Consistent representation	(Useful information) IQ dimensions Appropriate amount Relevancy Understandability Interpretability Objective
Service Quality	(Dependable Information) IQ dimensions Timeliness Security	(Usable information) IQ dimensions Believability Accessibility Ease of operation (changing the term from Ease of manipulation) Reputation Value-added (has been Removed)

Source: Adopted from (Kahn et al., 1998)

Even though many frameworks were introduced to measure and study the information quality in previous research, Price and Shanks (2005) proposed the limitations of previous frameworks with respect to either consistency or scope. Moreover, there is a lack of theoretical underpinning for the exploration of interdependencies or inter-relationships among those quality indicators proposed (Hill, 2004; Hu and Feng, 2005a; 2005b; Price and Shanks, 2005).

Figure 2.5 Comparison of information quality frameworks

This study	InfoQual	AIQM	IASB	ISO9000
Conforming to rules	Conforming to rules			
Reliable -Correct -Unambiguous -Meaningful -Non-redundant	Reliable -Correct -Unambiguous -Meaningful -Non-redundant	-Accuracy -Believability -Relevance -Objectivity -	-Reliability: free from error and bias -Constraints of relevant and reliable information -Relevance	
Complete	Complete	Completeness		
Understandable	Understandable	-Ease of understanding -Interpretability	Understand ability	
Accessible -Easy to access -Quick to access	Accessible -Easy to access -Quick to access	Access		Accessibility
Secure	Secure	Security		Secure
Suitably presented -Flexible presented -Appropriate to use - timely -Suitably formatted -Suitably precise -Suitably measured	Suitably presented -Flexible presented -Appropriate to use - timely -Suitably formatted -Suitably precise -Suitably measured	-Timeliness -Concise representation	Comparability	Timeliness
Valuable	Valuable	Value-add		
		Reputation		
		Amount of information		

Source: generated from literatures

IASB determine the usefulness of the financial information to its users. The IASB's qualitative characteristics of information are understandability, relevance, reliability and comparability. These criteria are concentrating on the quality of preparing, producing financial reports by business entities which encourage the information users of the financial information to use the financial information more effectively. The understandability of information as the information is readily understandable by users.

Hill (2004) proposed a model for organisational processes that classify a large number of customers into a relatively small number of partitions using attributes in a database. This model is built upon concepts from the IQ literature but uses Information Theory to define appropriate measures. He emphasises customer information quality that is suggested as being important information in supporting Customer Relationship Management (CRM) activities.

Price and Shanks (2005) proposed the InfoQual framework based on the semiotic theory, the philosophical theory of signs. The Semiotic Theory provides a theoretical basis for framework structure quality categories and their criteria. It also helps to integrate objective and subjective quality views. In the same article, they provide a comparison of the IQ frameworks of Wand and Wang (1996), Redman (1996), English (1996), Wang

and Strong (1996), Kahn et al., (1997) , Kahn et al., (2002), Lee et al., (2002) and their framework, the InfoQual in seven considerations: derivation and definition of categories; selection of criteria derivation method; derivation and definition of criteria; classification of criteria into categories; Inter-dependencies considered; criteria coverage ; and category and classification consistency. They concluded that the comparative analysis shows that all frameworks except their framework suffer from limitations in respect of consistency and coverage (Price and Shanks, 2005).

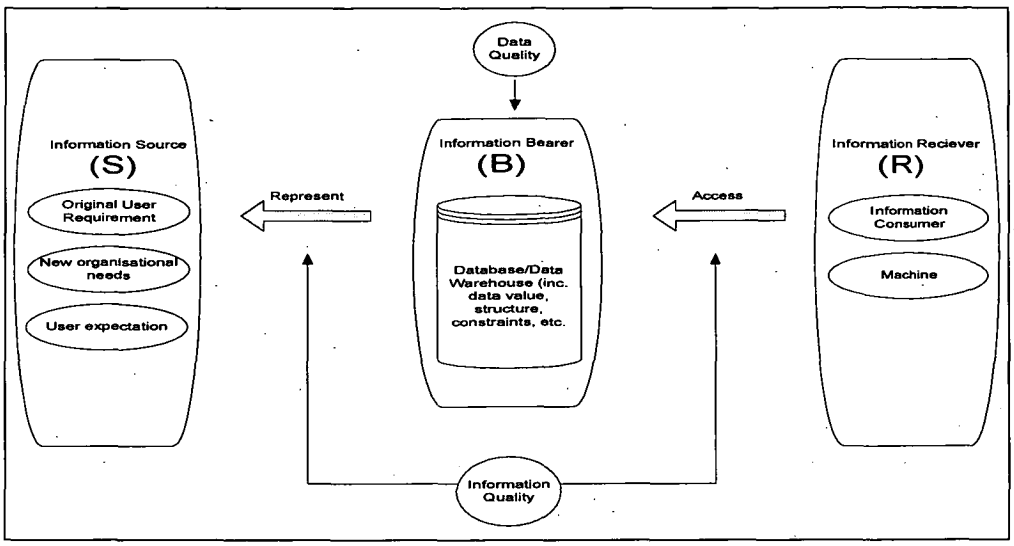
Hu and Feng (2005a) present a data and information quality model under the Information S-B-R framework based upon the theory of semantic information. This model consists of Source, Information Bearer and Information Receiver framework and the links between them.

"The Information S-B-R Framework is a highly abstract model for looking at information flow and information systems from a semantic information theory and organizational semiotic perspective" (Hu and Feng, 2005b:183).

Information Source (S) refers to an event related to the creation of information. Information Bearer (B) is the information flow or representation of Information. Receiver (R) is referred to as able to receive information carried by a bearer. They report a data-info quality model based upon an information-centric framework to provide a rigorous theoretical foundation for defining and distinguishing the terms data quality and information quality; discussing the inter-relationships between two terms; studying the subjective and objective characteristics of data quality and information quality.

The Data-Info Quality model (Figure 2.6) is concerned with two linkages between S and B, and between B and R, separately. The first linkage embodies the objective aspect of the problem following our ontological assumption on information. The model is being validated through a two-stage survey by interview to generate a data-info quality and survey by questionnaire to test the quality framework and categories quality criteria against the real world.

Figure 2.6 Data-Information Quality Model



Source: Adopted from Hu and Wang (2005a)

Hu and Feng (2005a) suggest that quantitative research methods will contribute to detecting and providing solutions to the problem. The second linkage should be looked at within a social setting. However, the data-info quality model is not fully developed in this study as the researcher reported that the objective characteristics of data quality and information quality, with a set of quality categories and criteria with their interdependencies articulated, will be reported in a future application.

Figure 2.7 comparison of quality criteria

Semiotic framework Pragmatic level	Sub dimension	This study
Conforming to rules	Conforming to rules	Obeys business and other integrity rules.
Reliable	Correct	Is correct.
	Unambiguous	Is unambiguous.
	Meaningful	Is meaningful.
	Non-redundant	Is non-redundant.
Complete	Complete	Includes all the information needed for your use of this data.
Understandable	Understandable	Is presented in a manner easy to interpret.
Accessible	Easy to access	Is easy to access.
	Quick to access	Is quick to access.
Secure	Secure	Is appropriately protected from damage or abuse.
Flexibly Presented	Easily manipulated and presentation customised as needed. Sub-dimension : easy to aggregate, easy to change units, precision	Can be easily manipulated and presentation customised as needed.
Suitably presented	Is presented in a manner appropriate for you use of this data.	Suitably presented
	timely	Is timely.
	Suitably formatted	Is suitably formatted.
	Suitably precise	Is suitably precise.
	Suitably measured	Is suitably measured.
Valuable	Valuable	Is used and is sufficient for your use of this data.
Relevant	type of data available	Types of data available are pertinent to your use of this data.

Source: generated by literatures

2.3.2.5 The assessment of information quality in organisations

There is a number of studies assessing the data and information quality in organisations. Xu, Nord, Nord and Lin (2003) test the accounting information quality from organisations' accounting software. They use the case study by interviews method to examine the real world situation of four large Australian organisations. Five types of stakeholder are focused on in this study which are: information producers; information custodians; information consumer information managers; and internal auditors. The accounting information quality dimensions applied in this study are accuracy, timeliness, completeness and consistency.

Li and Lin (2006) examine the impact of environmental uncertainty, intra-organisational facilitators and inter-organisational relationships on the information sharing and information quality in Supply Chain Management (SCM). The information quality dimensions testing in this study are: accurate; complete; adequate; and reliable.

Palsson (2006) studies the information quality in industrial environmental management. A set of information quality dimensions from ISO14000 series standards were used to

examine the information quality in environmental management. This study uses different methodologies which are: detailed literature review to learn how information quality is handled; and the case studies method to address identified environmental information quality problems with industrial and academic practitioners. The major part of this study is based on a detailed literature review with the different projects within the research group Industrial Environmental Informatics during 1996-2002. Information quality dimensions of this study were grouped into the four dimension categories of Wang and Strong (1996) but the quality dimensions were replaced by related terms that are used for environmental information suggested in ISO9000 and ISO14000. They proposed 16 dimensions which are accuracy, credibility, reputability, reproducibility, verifiability, appropriate amount of data, completeness, relevancy, useful, timeliness, consistent presentation, transparency, understandability, clarity accessibility, and availability.

2.3.3 Delivery of information

There are several ways to deliver information to its users. Wilson (1993) provides several examples of information communication methods in organisations such as telephone, meeting, written material, computer network, computer disks, video and audio-tape.
An electronic information system is one channel to deliver information to information users but that information system is needed to coordinate and control the flow of information in an organisation. Wilson (1993) adds that the shape of the information system must reflect the chain of command and channel of communication shown on the organisation chart. Some organisations chose to make their own information system which the organisation has to pass through the process of information system development and design in which the system can be customised to fit with every organisational function and task. The other alternative is adopting the commercial software which can be classified in many types of software available in market.
The management teams have responsibility to deliver information to the organisations' members by adopting information systems to capture, collect, store and produce information to information users at least as good as the traditional accounting information system.

Accounting systems are compulsory for business entities in order to provided financial information for different stakeholders and compliance with regulations. The accounting system has played an important role in providing information to support both internal and external information users in the industrial era. In globalization, the business environment of organisations being more complex and changing rapidly leads to organisations needing more capacity in information systems in providing information to support internal information users. At the same time, information technology has been improved to handle large amounts of business transactions and produce much information to support decisions.

An electronic information system is one of the methods to deliver information in modern organisations. Management information system literature proposes that management information systems should supply the basic information that managers need in order to make decisions (Mason, 1969). However, the electronic information systems typically designed and implemented are based on the system requirements of manual systems. This means information technologies are used instead of humans. Generally, the information designers determine what information is required by asking managers what information they would like to have which is based on the assumption that managers know what information they need and want (Ackoff, 1967). In order to know what information manager needs, the manager must be aware of each type of decision the manager should make and must have an adequate model of each.

Enterprise information systems normally have a purchasing function as the starter module of the systems as the purchasing system is the first phase of the whole system.

Dobler and Burt (1996) explain the processes of computerized material management systems; typically the processes of all computer-based systems are involved with the same activities as manual-based system. The Materials Requirement Planning (MRP) systems are the combination of software, hardware and communication channels developed to enable the material control and manufacturing organisations to plan priorities more effectively (Johnson and Williams, 1982). They also add that MRP is of interest to purchasing personnel as it is a viable tool to use with the sub-contract suppliers and manufacturing and operating departments.

The processes' records and data maintenance have to be entered by humans except for the data received in electronic form.

2.4 Summary

This chapter reviewed the literature relating to the research questions of the study. The literature covers the information and information systems in business, information required for decision-making, information quality and delivery of quality information. The review of information and information in business presented the importance of information in competitive business environment and its importance to decision making. The situation of information systems in Thai business is also provided. The review of information required for decision-making was scoped in the purchasing department. The responsibilities of purchasing departments were reviewed from the academic textbooks and trade association literature. The list of responsibilities was used to identify the decision-making topics within the responsibilities. In this process, the literature states a rich list of decision topics in the buying responsibility of the purchasing department. This led to review of the types of information in the buying responsibility from the academic and trade association literature. The review of information quality and delivery of quality information highlighted a number of available information quality frameworks and information quality dimensions. The information qualities criteria from the InfoQual framework are expected to be used in this study as they are developed from the information theory and focus on the information consumers.

Chapter 3

Development of Conceptual Framework

3.0 Introduction

In this chapter, information theory and communication theory are reviewed to form the appropriate terminology of 'information' and 'information system'. Then, theory of information system, information system success model and system development process are reviewed to form a conceptual framework. The framework of this study is developed to examine the adequacy of enterprise information systems in providing the information requirements of Thai manufacturing companies. Next, the variables used to examine the adequacy of an information system from the conceptual framework are identified together with the set of propositions to test the information currently available to Thai manufacturers and the information needs of the users.

3.1 Theories considered

In this section, theories, models and frameworks related to information and information systems are described as it is commonly accepted by researchers that research in the information system field lacks theoretical support. However, theories considered relevant to this study, communication theory, information theory, and information system success model, are discussed in the next section.

3.1.1 Communication Theory

Communication theory is usually thought to include information theory and semiotic theory. Communication theory is considered to be relevant to this study in the sense that communication is the information flow.

3.1.1.1 Information Theory

The first attempt to design an information theory was made by Shannon and Weaver. They wrote that their information theory did not involve information itself but the amount of information in a system and its transmission from sender to receiver which is the pure mathematical formula (Shannon and Weaver, 1916). Cover and Thomas (2006) claim that information theory is a sub-set of communication theory. They said

that information theory was developed to answer two questions; what is the ultimate data compression and what is the ultimate transmission rate of communication.

3.2.1.2 Semiotic point of view

Semiotics or the science of signs describes communication such as using a sign as the form, meaning of a sign and use of a sign (Anderson, 1997:126). He added that the sign in the sense of semiotics refers to all kinds of signs: verbal language, literature, picture, body language and movies. Computer semiotic discipline is the study of the nature and use of computer-based signs which link the concept of information and communication.

In semiotic theory, the information is viewed from three perspectives which are syntactical, semantic and pragmatic (Fleissner and Hofkirchner, 1996). Anderson (1997) said that semiotics is the science of signs and their life in society. He claimed that the primary function of computer systems is to work as a sign-vehicle from the semiotic point of view. The syntactic level is concerned with the form of sign or the form of information in any information study. The semantics level is concerned with the meaning of signs or meaning of information in the way a sign is expressed or the way the sign is related to the interpreter. The pragmatics level looks at the use of signs or use of information such as intentions, responsibilities and consequences behind the expressed statement.

Researchers have used different aspects of communication theory to study information and information systems such as Price and Shanks (2004) who adopted the semiotic discipline to develop an InfoQual framework to test the quality of information. Hill (2004) also used the semiotic discipline to develop the information quality framework to test the customer information quality while Floridi (2005) studied the information from the semantic point of view.

3.1.1.4 What is information?

There is no universally accepted meaning of 'information'. Since the 1970s, several definitions for the term 'information' have appeared and most of the definitions tied the meaning of 'information' with the terms 'data' and 'knowledge'. Information is data arranged in ordered and useful form to achieve specific purposes and enhance understanding (Sanders, 1973). In this study, information refers to data and

information from the EIS which are useful to support the decision making of managers.

3.1.2 Nature of information systems

In a similar way, the term information system also has different interpretations among different groups of people. Falkenberg, Hesse, Lindgreen, Nilsson, Oei, Rolland, Stamper, Assche, Verrijn-Stuart and Voss (1998) state that the "information systems" concern the use of "information" by persons or groups of persons in organisations, in particular through computer-based systems.

The information system discipline seems to have broad theoretical support but in reality the theory that underpins the information system discipline is so poorly developed. Broad theories which might be expected to underpin research in the information system field are system theory, information theory, communication theory and information economics. Presently, existing theories related to the information concept are claimed not to be related to the nature of theory. Checkland (1999) argues that there is no simple link between systems theory and how the information system works. Similarly, a mathematical theory of information is a mathematics formula used in calculating the quantity of information flow in the system rather than how an information system works. The term information system can be defined in many ways. Romney and Steinbart (2003:2) gave a definition of an information system as"a set of two or more interrelated components that interact to achieve a goal". An information system consists of the components of hardware, software, infrastructure and trained personnel organised to facilitate planning, control, coordination and decision making. An information system is a business application of the computer; it is made up of the database, application programs and manual and machine procedures. It also encompasses the computer systems that do the processing.

Any explanation of an information system should include the management, organisation and the technology of the information system (Laudon and Laudon, 2002).This is because an information system is the result of integration of the information technology to fit with the social system such as the management system. The information systems in organisations could be acquired in several ways such as buying a software package or developing a customised information system from in-

house development or outsourcing. Even though the adoption of an information system is expensive; it is vital that organisations have to re-invest in a new system at some point to make the information system fit with the organisation. Laudon and Laudon (2002) suggested that information systems have to optimise their performance to fit in with the needs of the organisation. In some cases, the technology may have to be 'de-optimized' to accomplish the fit at some point. From a technical viewpoint, Xu (2000) defined an information system from two perspectives: one relating to its functions; the other to its structure. From the functional perspective, an information system is a technologically implemented system for the purpose of recording, storing and disseminating data/information. From a structural perspective, an information system consists of a collection of data, models, processes, technology and people, all forming a cohesive structure which serves some organisational purpose or function. The main structure of an information system comprises the real-world system that the information system is intended to model. To design an information system, the real-world system should be analysed and converted; the entire element and process is connected into the information system design requirement. The requirement of an information system can be classified into many types such as interface requirement, process requirement and information requirement. The most critical requirement is the information requirement the results of which will affect the information system overall because information as the output of the system will govern the input and process of the system.

3.1.2.1 Types of information system

Information systems have been classified by several criteria such as manual information system versus computer-based information system, or online-processing information system versus batch processing information system. In the next section, more descriptions of manual information systems and computer-based information systems are presented; however, the term information system in this study focuses on the computer-based information system only.

A. Manual Information Systems

Romney and Steinbart (2003) defined a manual information system as one in which most of the data processing load is completed by people without the use of computers. For example, the traditional financial accounting system is an example of a manual

information system. The analysis and recording of transactions in the journal of the financial accounting system is the input process of the manual system. After the transaction is recorded in the journal, each side of the record is transferred to the general ledger which is worked like a table in a computer-database system. At year end, the data in the general ledger are summarised and generate the outputs of the financial accounting system which are balance sheet, profit and loss statement, cash flow statement, etc.

Manual information systems have several drawbacks compared with computer-based information systems. The manual systems may have less capacity to process large-volumes of data and take more time to process the same amount of data compared with the computer-based systems. The output of manual systems may be less accurate because of the checking and validating process.

"However, in some situations the manual system can be more adequate or indeed superior to computerised information systems, such as in a small business, or where the particular flexibility or human judgement is required" (Avison and Fitzgerald, 2006:3).

B. Computer-based information systems

The computer-based information system is one where the computer processes data speedily and accurately and provides information when and where required, which is complete and at the correct level of detail, so that it is useful for some purpose (Avison and Fitzgerald, 2006).

Computerised information systems have been proven to be effective in controlling systems while manual information systems hardly meet the requirements of a quick-response environment. Computer-based information systems in business are commonly categorised by the level of the systems' users in an organisation or management level. Each category of information system has unique system elements and characteristics as shown in Figure 3.1.

Figure 3.1Characteristics of Information Processing Systems

Categories of IS	Inputs	Processing	Outputs	Users
Executive Support System (ESS)	Aggregate data External, internal	Graphic; simulations; interactive	Projections; responses to queries	Senior Managers
Decision Support System(DSS)	Low-volume data or massive database optimised for data analysis; analytic models and data analysis tools	Interactive; simulations; analysis	Special reports; decision analyses; responses to queries	Professionals; staff managers
Management Information System (MIS)	Summary transaction data; high volume data; simple mode	Routine reports; simple models; low-level analysis	Summary and exception reports	Middle Managers
Knowledge Work and (KWS)	Design specifications; knowledge base	Routine reports; simple models; low-level analysis	Summary and exception reports	Middle Managers
Office Systems (OS)	Documents; schedule	Document management; Scheduling; communication	Documents; schedule; mail	Clerical workers
Transaction Processing System (TPS)	Transactions; events	Sorting; listing; merging; updating	Detailed reports; lists; summaries	Operations personnel; supervisors

Source: Adopted from Laudon and Laudon (2002:41)

The term Enterprise System (ES) has been an emerging trend in the information technology (IT) solutions in recent years (Kawalek and Wood-Harper, 2002).They are also referred to as Enterprise Resource Planning, Enterprise-Wide Information Systems and Enterprise Systems (ES)(Loonam and McDonagh, 2005). The EISs are software packages that integrate an organisation's business processes and are generally built to fit the generic needs of many organisations by using reference models. A benefit of EISs is an improvement in data and information quality as the EISs integrate all data and information of the organisation by themselves in a large data storage which helps to reduce redundancy and validity problems. In contrast, the stand-alone information systems might face problems of data redundancy and data validity as a result of the duplicate entry and storing the same pieces of data and information in separate information systems.

3.1.2.2 Acquisition of an information system

The organisation has to choose whether to develop a customised system or to buy a software package. These two options have their own benefits and drawbacks.

A. In-House development

In-house development is one alternative for an organisation to acquire an electronic information system. Using this approach, organisations also can choose the method of development of the system from their resources or outsource. Both methods mean that the organisation participates in the system development process which comprises system analysis, system design, system implementation and system testing. The system analysis and design are the most important processes of the information system development process as they are involved with gathering the requirements of the users of information systems. The requirements of an information system can be classified in many categories but the most important requirement is the information requirement. Information requirements are the general terms in the information system development process. Generally, the information needs are related to the activity in which that information is used. Wetherbe (1991) states that the big problem in the system development process is correctly determining information requirements and designing the right system .The information requirement in the current system analysis and design processes is more concerned with the terms of quantity or type of information.

B. Commercial software package

In the business management software market, there are many types of commercial software packages available. The most general business software package is the accounting software package that has the ability to control the whole process of the small to medium enterprise such as MYOB.

Enterprise Resource Planning (ERP) is a class of package software (Soh, Kien and Tay-Yap 2000). Davenport (1998) adds that ERP is a software package that has been adopted around the world. Most adopting organisations hoped to re-engineer quickly and standardise the majority of their business processes to reflect best practice processes. At the same time, organisations sought to configure the systems so that they aligned with the

organisation's business processes and objectives and to restructure simultaneously their organisations and processes to take advantage of new data. Davenport (1998) mentioned that organisations desired improved decision making more than any other benefit of the enterprise system. Driven by a desire for accurate, consistent, complete, real-time information, executives are seeking the same type of efficient, transparent and "frictionless" real-time decision-making capability that many manufacturers achieved with just-in-time manufacturing.

ERP packages were reported as 'misfit' in many aspects. The output 'misfit' arises from incompatibilities between organisational requirements and the ERP package in terms of presentation format and the information content of the outputs (Soh et al., 2000). They studied the 'misfit' of ERP in three contexts such as company-specific, public sector-specific or country-specific requirements and report that the most significant output misfit is because the information is not available. Soh et al.,(2000) suggested that the 'misfit' may be worse in Asia because the business models underlying most ERP packages reflect European or the United State industry practices which differ from the Asian organisations in terms of culture, economics and regulatory context.

3.1.2.3 Output of information system

Outputs from an information system can be made available in many forms, such as messages, reports, forms, images, sound, diagrams and multimedia.

A. Types of information

The types of information from an information system are normally determined by designers who consult with the managers or users about the information they would like to have, based on the type of decision or action for which the information is used (Ackoff, 1967). He also points out the results from many investigations and practice show that managers do not know what information they need.

B. Information quality

Information quality was used to measure the information system in different dimensions. Many information quality sets were proposed to use in different situations. Wang and Strong (1996) caution that information system professionals should seek not only to

improve data accuracy, but also to consider data accessibility and data relevance as they relate to the information tasks of the customer. Most of the information system users' satisfaction models use information quality as criteria to measure users' satisfaction as well as in some information system quality models (Wu and Wang, 2003).Information quality is described as the characteristics that make information products valuable to users. O'Brien (2003) suggests three dimensions of information quality which are time dimension, content dimension and form dimension Figure 3.2.

Figure 3.2 A summary of the attributes of information quality

Time Dimension
Timeliness: Information should be provided when it is needed.
Currency: Information should be up-to-date when it is provided.
Frequency: Information should be provides as often as needed.
Time Period: Information can be provided about past, present and future time periods.
Content Dimension
Accuracy: Information should be free from errors.
Relevance: Information should be related to the information needs of a specific recipient for a specific situation.
Conciseness: All the information that is needed should be provided.
Completeness: Only the information that is needed should be provided.
Scope: Information can have a broad or narrow scope, or an internal or external focus.
Performance: Information can reveal performance by measuring activities accomplished, progress made, or resources accumulated.
Form Dimension
Clarity: Information should be provided in a form that is easy to understand.
Detail: Information can be provided in detail or summary form.
Order: Information can be arranged in a predetermined sequence.
Presentation: Information can be presented in narrative, numeric, graphic, or other forms.
Media: Information can be provided in the form of printed paper documents, video displays, or other media.

Source: Adopted from O'Brien (2003)

Wand and Wang (1996) proposed a possible deficiency in the data quality model between the view of information systems' users and the view of the real world information systems. Even the view of real world information is transformed to the information system environment.

Price and Shank (2004) developed the InfoQual framework. This framework was designed to be integrated into common and existing operational approaches to information systems specifications based on the semiotics theory. Information quality

criteria and the sub-dimensions suggested in the InfoQual framework (Figure 3.3) were adopted in this study as it matched with the conceptual framework and main objective of this study.

Figure 3.3 InfoQual information quality criteria

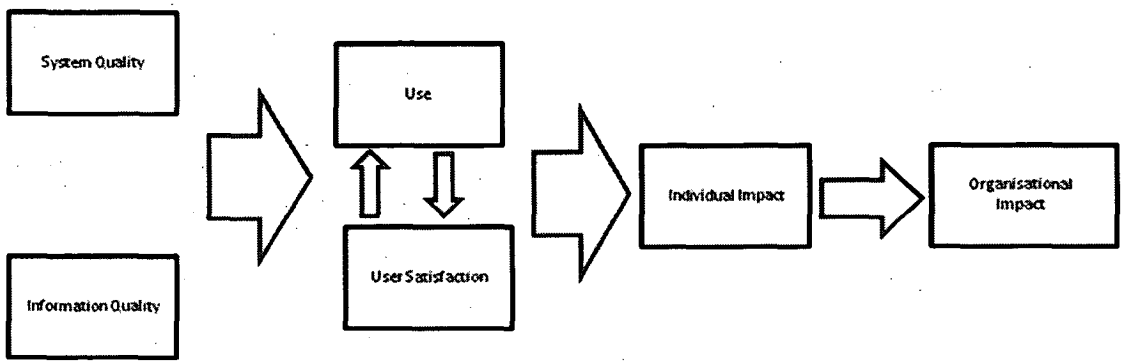
Conforming to Rules: Data obeys business and other integrity rules.
Reliable: Data corresponds to (i.e. is a trustworthy representation of) relevant external phenomena. Sub-dimensions: correct, unambiguous, meaningful, non-redundant.
Complete: The collection of data (i.e. data extent) includes all the information needed for your use of this data.
Understandable: Data is presented in a manner easy to interpret.
Accessible: Data is easy and quick to retrieve. Sub-dimensions: easy to access, quick to access.
Secure: Data is appropriately protected from damage or abuse (including unauthorized access).
Flexible presented: Data can be easily manipulated and the data presentation customised as needed. Sub-dimensions: easy to aggregate, easy to change (i.e. convert) unit, precision, or presentation.
Suitably presented: Data is presented in a manner appropriate for your use of this data (i.e. your work). Sub-dimensions: timely, suitably formatted, suitably precise, and suitably measured (with respect to units).
Relevant: The types of data available (i.e. data intent) are pertinent to your use of this data.
Valuable: The data is useful and sufficient for (i.e. important for) your use of this data.

Source: Adopted from Price and Shanks (2004)

3.1.3 Information system success model

The information systems cannot be explained alone as the information system needs to be described in the terms of the technical and organisational aspects of the system (Laudon and Laudon, 2002). The information system and information management studies were normally based on adopting a variable from existing frameworks and models to form their conceptual frameworks. In 1992, DeLone and McLean proposed the DeLone and McLean IS success model (D&M IS Success Model) (Figure3.4). The model is based on the Shannon and Weaver (1916) process model of information systems.

Figure 3.4 D&M IS success model



Source: Adopted from DeLone and McLean (1992)

The D&M IS Success Model comprises six major dimensions or categories of information success – system quality, information quality, user, user satisfaction, individual impact and organisational impact. The D&M IS Success Model is cited and adopted to measure success of many types of information system such as ERP system, E-Commerce, Knowledge Management System (Wu and Wang, 2006), Data Warehousing (DW), Customer Relationship Management (CRM), Free and Open source software (Chung, Skibniewski and Kwak, 2009; Molla and Licker, 2001; Nelson, Tood and Wixom, 2005; Wu and Wang, 2006).

Ten years later than 1992, DeLone and McLean revisited the D&M Model and gave some suggestions about their model. DeLone and McLean revised the D&M IS Success Model and pointed out that many cited articles misused their model. They emphasised that IS success is a multi-dimensional construct and researchers should combine the measure from the IS Success model to create a comprehensive measurement instrument.

3.1.4 Best Practice Method

The ideal of best practice can suggest opportunities for improvement in very specific ways. Best practices are rapidly becoming a way of improving cycle time. Over the past decade, industry has come to recognise the full power of reducing the amount of time it takes to do things. Best practice is any technique, method, process, activity, incentive or reward that is believed to be more effective at delivering a particular outcome than any other technique, method, process, etc. The idea is that, with proper processes, checks and testing, a desired outcome can be delivered with fewer problems and unforeseen

complications. Best practice can also be defined as one of the most efficient and effective ways to accomplish tasks, based on repeatable procedures that have proven themselves over time for large numbers of people.

Best practice methods are widely used in many areas such as medical treatment, quality assurance and management requirement such as information system requirement management.

Japanese companies being good examples of extraordinary process and product improvement success leads to Japanese practice being more specific suggestion and more actionable practices such as JIT. Western industries and academics alike began to look at Japanese companies' achievements in order to understand the principle behind them. Costs come down, customers are willing to pay for something done or delivered more quickly, competition is straight and improvements come earlier. Best practice benchmarking, the measurement and implementation of the most successful operational standard or strategy available in an industry, can be one of the most effective tools for increasing a corporation's efficiency, productivity and ultimately earnings (Natterman, 2000). "Best practice" achievement has since become a driving force amongst industry. The best practice approach to manufacturing strategy encapsulates the world class manufacturing (WCM) philosophy and benchmarking, and is based on the assumption that it will lead the organisation to superior performance capability leading to increased competitiveness (Voss, 2005).

The basic principle of best-practice thinking is that operations, philosophies, concepts and techniques should be driven by competitive benchmarks and business excellence models to improve an organisation's competitiveness through the development of people, processes and technology (Voss, 2005). Best practice can be viewed as a method to set the rules or good standard that can apply to many areas such as medical practice and management. However, best practice is weak in the area of information system development and the requirement management is one of the areas that best practice can be applied but few studies have been done in the area.

3.2 Development of a conceptual framework

The main object examined in this study is available information from the enterprise information system as organisations nowadays depend on the electronic information systems. Available information is the power and resource in running organisations towards their goals. To answer whether the current enterprise information systems adopted by Thai manufacturing companies are adequate to meet their needs, the conceptual framework of this study was developed by reviewing and choosing relevant variables. The study of information requirements is most concerned with how a user navigates a given system and what he or she could do with the data (rather than information) made available by that information system (Wilson, 2000).The concept of user information satisfaction can be traced to the work of Cyert and March (1963) who suggested that an information system which meets the needs of its user will reinforce satisfaction with that system.

Much of the literature on information system use considers meeting user requirements and user satisfaction. In this study, the interest is in the input and output of the information system so the system itself is treated like a black box. The interest is only in information. However, the Information system success models have many criteria to assess success, e.g., technical, but in this study only the scope and quality of information are considered.

3.2.1 The Conceptual Framework

The conceptual framework of this study is an attempt to test the information product from the enterprise information; the mechanism of the system is not considered (Figure 3.5). The framework was constructed to test the information quality and the types of information in three aspects. The information quality variable was adopted from the D&M IS Success model which measures the information system output or information (DeLone and McLean, 1992).

3.2.2 The Variables

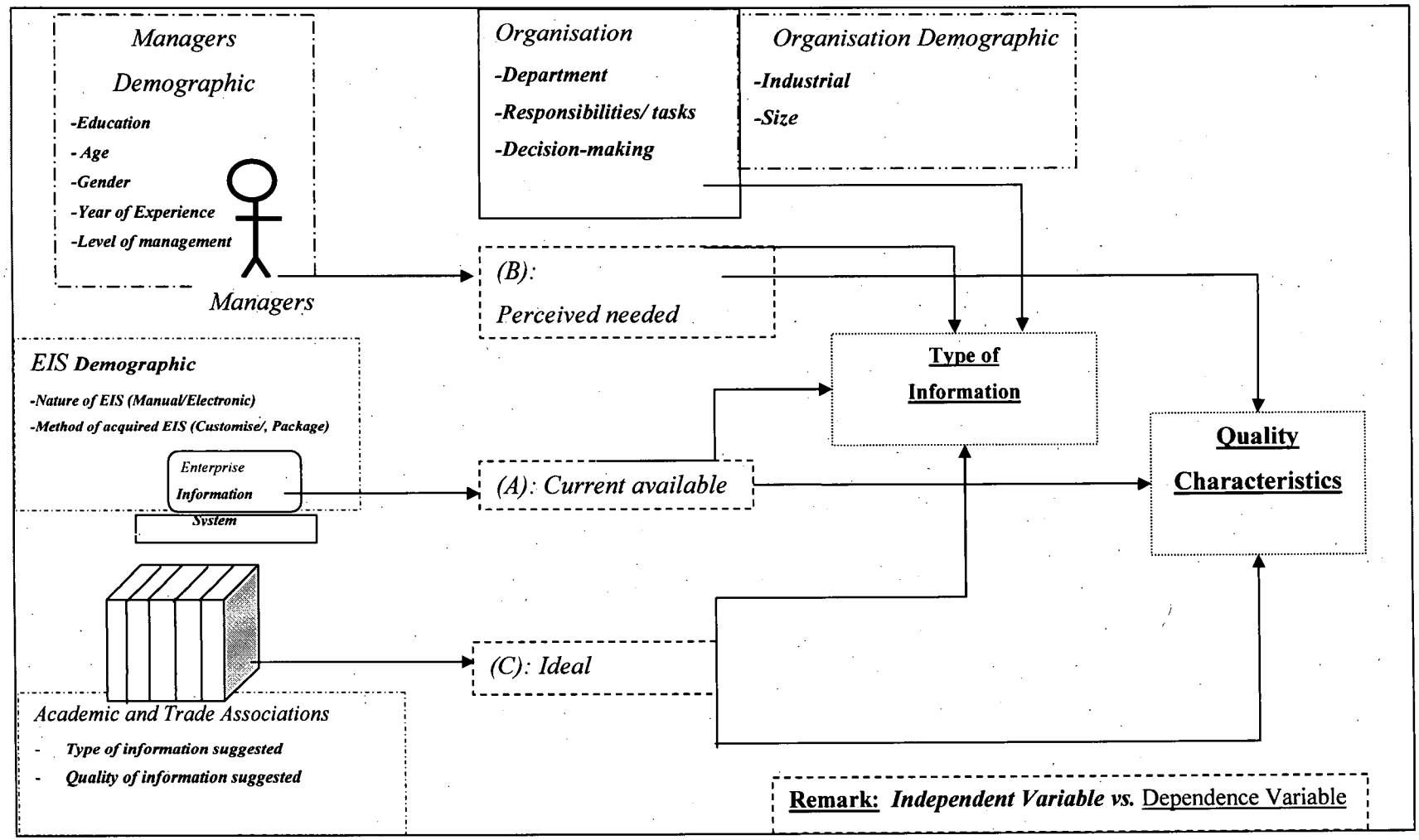
The variables in this research have been grouped into the categories identified in the conceptual framework Figure 3.5. The conceptual framework proposes a set of

independent variables which comprise demographic data of managers; organisations and enterprise information systems; perceived need; currently available and ideal status of information qualities; and types of information. The dependent variables of this study are types of information and quality characteristics of information.

Information quality is generally perceived as a multi-dimensional construct that consists of a number of criteria such as timeliness, accuracy, relevance, etc. Within organisations, information quality is relevant for most information-intensive applications.

The discrepancy between the Information Quality (IQ) dimensions might be explained by two reasons. First, the differences in the business environment and culture that occurred through the decade that separates investigators (Najjar and Schniederjans, 2006; Roldan and Leal, 2003; Wu and Wang, 2006).Second, the changes in the business information content, size, form, characteristics and obvious changes in the information presentation and management facilities that have taken place.

Figure 3.5 The conceptual framework



Source: developed based on literatures

3.2.2.1 Discussion of variables relationships

The problem is to determine how two or more variables are related to one another. This can be investigated by hypothesising the relationships that may exist among the variables. The types of information available are expected to depend on types of current enterprise information systems. Information quality is claimed to interact with user satisfaction and intention to use. DeLone and Mclean (2002) suggest that the type of information system may be the cause of success of information, e.g., the ERP adopted may (or may not) lead to improved information quality (DeLone and McLean, 2002).

The gap between the types and qualities of information available from current EIS and the needs of managers might be high among the companies adopting the ERP as the literature reports a misfit issue in Asian country where the industry practices differ from the ERP packages which reflect European or the United State industry practices (Soh et al., 2000).

3.2.2.2 Nature and direction of the relationships

If the nature and direction of the relationships can be theorised on the basis of the findings from previous research, then there should be a test to discover whether the relationships would be negative or positive.

The type of current operating information system suggested has relationships with both types of information available and the level of information quality. DeLone and McLean (2003) add that some variables such as using the ERP may lead to improved information quality. Some quality criteria such as security, accessibility of information from computer-based information system might be higher than those from the manual system. The type of current enterprise information system used to provide the information for managers is expected to have relationships with the level of available types of information and the level of information quality. However, some authors argued that the ERP packages were found to misfit in many aspects that include the information misfit. The authors also added that the situations might be worse in Asian country as Thailand is one of the Asian countries. As well as the idea that not every business process needs to be computerised, it might be found that in some situation the information produced by the

manual based information system might be effective in both quantity and quality of information.

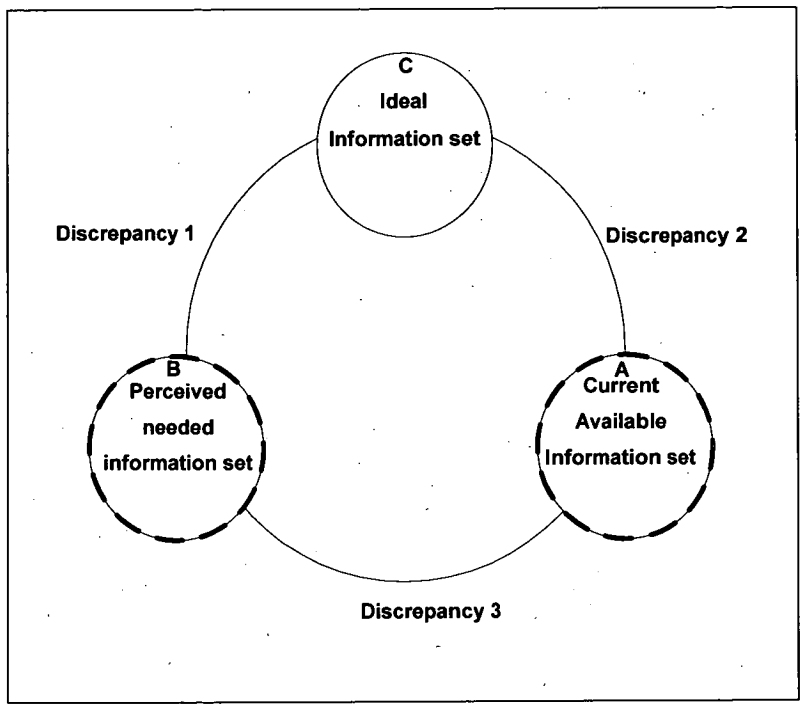
The level of types and quality of information available from the current enterprise information system are expected not to meet the needed of mangers.

The best practice types of information and information quality suggested from the academic and trade organisations are suspected not to be established among the Thai organisations as those practices were established in a different business environment.

3.3 Method of study

The three rings model (Figure 3.6), developed from Figure 3.5, is all about the information requirement (need) in three different views as in this study the information needs of Thai manufacturing firms will be examined from three perspectives. First, the current information view (set A) will draw attention to the ability of the current EIS in make available the information required by its users. The currently available information from the current enterprise information systems of Thai manufacturing companies will be identified and compared to the ideal of a model set of information. These data will be collected in a questionnaire survey of managers in Thai manufacturing companies. Next, the perceived needed information set (set B) is a set of information and level of quality that are expected from the user's point of view. The information needs identified by managers will be considered and contrasted with the 'ideal' set and the 'currently available' set of information. Last, the ideal information set (set C) provides the firm's understanding of information required in buying decisions from academic textbooks and trade organisations; it is an identification of ideal or best-practice information. This will involve an examination and analysis of the related literature.

Figure 3.6 Method of study



Source: developed based on literatures

The three perspectives of information are presented in Figure 3.6. These three perspectives of information are: A, the currently available information set; B, the perceived needed information set; and C, the ideal academic and trade associate suggested information set. These three perspectives (A, B and C) will be analysed as discrepancies, as follows.

Figure 3.7 Discrepancy 1

Discrepancy 1 = C - B
C= ideal academic and trade associate suggested information set
B= the perceived needed information set

Discrepancy 1 (Figure 3.7) will present the difference between what the academic and trade associations think are relevant information in specific tasks and its quality and the information perceived to be needed by managers in Thai manufacturing companies which is the gap between the academic and trade organisation view and the real needs of managers in Thai manufacturing companies.

Figure 3.8 Discrepancy 2

Discrepancy 2 = C – A
C= ideal academic and trade associate suggested information set
A = the currently available information set

Discrepancy 2 (Figure 3.8) will show the difference between 'ideal' information needs and 'available' information which is the gap between the ideal information set and the characteristics of information provided by the current enterprise information systems. This discrepancy could be used to benchmark the current enterprise information system against the best practice.

Figure 3.9 Discrepancy 3

Discrepancy 3 = B-A
B= the perceived needed information set
A = the currently available information set

Discrepancy 3 (Figure 3.9) will show the difference between the available information set and the information perceived to be needed by managers in Thai manufacturing companies. This will be presented as the area of improvement required in current enterprise information systems.

3.4 Research propositions

The three propositions were set to answer the main research question of this study.

> Proposition 1: There are gaps between the ideal information set and those perceived to be needed by managers in Thai manufacturing companies.

The ideal information based on the best practices in academic and trade associations mentioned and that perceived to be needed by managers in Thai manufacturing companies are expected not to match in terms of qualities of information and types of information.

Proposition 2: There are differences between the ideal academic and trade associations suggested information set and the information available from the current enterprise information systems.

The ideal academic and trade association suggested information set and the information available from the current enterprise information systems are expected to be different in terms of nature of information and quality. Many authors have found out that information systems tend to mismatch with user expectations.

Proposition 3: There are differences between the information perceived to be needed by managers in Thai manufacturing companies and the currently available information set.

The information set perceived to be needed by managers in Thai manufacturing companies and the currently available information set available from current enterprise information systems are expected to be different in both nature of information needed and quality of information.

3.5 Summary

This chapter presented the relevant theories and frameworks used to underpin this study, the development of the theoretical framework and the information model of Thai manufacturing companies. Currently, the studies in information and information systems lack theory to underpin them. Therefore, a set of dependent and independent variables was developed to form the conceptual framework to underpin the study. The information quality and type of information from three different aspects: academic best practice, users' needs: and information currently available from enterprise information systems, were adopted in this study to form the conceptual framework and set the propositions to examine the adequacy of the enterprise information system to meet the information requirement of users. In the next chapter, the research methodology is presented.

Chapter 4

Research Methodology

4.0. Introduction

This chapter presents the rationale behind the selection of a research methodology for the study. In the first section, the propositions are presented. Then, a step-by-step description of the survey design process, including preliminary considerations of research methods, participants in the study, data collection, the designation of survey instruments, reliability and validity of the survey instruments, variables, pre-testing, sample, rules on ethics and confidentiality and the questionnaire translation process are discussed. The statistical methods adopted for data analysis techniques are described in the final section.

4.1. Research propositions

Three propositions were put forward to answer the main research question of this study.

> Proposition 1: There are gaps between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies.

The ideal information based on the best practices mentioned in academic and trade association articles and that perceived to be needed by managers in Thai manufacturing companies are expected not to match in terms of quality of information and type of information.

> Proposition 2: There are differences between the ideal academic and trade associations suggested information set and the information available from the current enterprise information systems.

The ideal academic and trade associations suggested information set and the information available from the current enterprise information systems are expected to be different in terms of nature of information and quality. Many studies found that information systems tend to mismatch with the user expectations.

Proposition 3: There are differences between the information perceived to be needed by managers in Thai manufacturing companies and the currently available information set.

The information set perceived to be needed by managers in Thai manufacturing companies and the currently available information set available from current enterprise information systems are expected to be different in both nature of information and quality of information currently available.

4.2. Research design

This study was developed under the survey schema by using two surveys, an administered questionnaire and a mail-out questionnaire to collect information from people to describe, compare or explain their knowledge, feelings, values and behaviour.

4.2.1 The survey research

Survey research is a quantitative research method which acquires standardized data about the subjects being studied. A set of information is collected from each case, the cases are directly comparable and we end up with a structured set of data (De Vaus, 2002). The survey method is useful to describe the characteristics of a large population such as the one of interest in the study. Survey research can cover large samples with low cost, especially self-administered surveys. Typically, surveys take the form of self-administered questionnaires and interviews. The survey method can also be operated from a remote location by mail, email, telephone and web-based questionnaire.

The literature suggests three distinct characteristics of survey research (Pinsoneault and Kraemer, 1991). First, the purpose of a survey is to produce qualitative descriptions of some aspects of the study population. Second, the main way of collecting data is by asking people structured and predefined questions. Third, data are generally collected about only a sample of the study population but they are collected in such a way as to be able to generalise the findings to the population. De Vaus (2002:81) stated that when dealing with small samples a small increase in sample size can lead to substantial increase in accuracy when the survey is dealing with the small sample size"

De Vaus (2002:58) mentioned that "Any survey will be shaped by three broad sets of considerations: technical, practical and ethical". The author adds that the technical consideration is to ensure that sample design, questionnaire construction, scale development and the like are as rigorous as possible. The practical considerations mean that the survey design must take account of realities such as budgets, deadlines and the purposes of the research. The ethical considerations shape the final design of a survey and distinguish among responsibilities to survey respondents and those to colleagues, sponsors and the public.

Fink(1995) suggested the features that the best survey research must have: specific objectives; straightforward questions; sound research design; sound choice of population or sample; reliable and valid survey instruments; appropriate analysis; accurate reporting of survey results; and reasonable resources (Fink, 1995).

A critical issue of survey research design is determining the unit of analysis or the unit about which statements are being made. The units of analysis might be individuals, groups, departments, organisations or communities (Fink, 1995).

There is a wide range of survey techniques available in survey research such as mail surveys, group administered questionnaires, drop-off surveys and oral surveys. In Table 4.1, the comparison of survey types is presented with characteristics, advantages, disadvantages, special needs and costs of each type.

Table 4.1Comparing survey types

	Self-administrated			Interviews	
	Mailed	On-site	Online	Telephone	In-Person
Characteristics	Paper and pencil	Paper and pencil	Internet based	Can be done with written script or computer assisted	Can be done with written script or computer assisted
Advantages	- Can reach large geographic areas - People can used to completing paper-and-pencil surveys -Can take the survey with you and complete it anywhere	-Information is obtained immediately -Questions about survey can be asked by respondents as they arise -In some cases, surveys can be done with groups of people	-Worldwide -Order of questions can be pre-programmed -Only "legal" answers are accepted -Can give respondent links that explain unfamiliar words and help with difficult questions -Data are automatically entered and can be automatically analysed	-Can explore answers with respondents -Can assist respondent with unfamiliar words	-Can explore answers with respondents -Can assist respondent with unfamiliar words
Disadvantages	Need a sample to return survey. - Many people think they have too much to do without also having to complete survey. -Respondents must be able to read, see, and write.	-Limited to response from just those who are onsite -Respondents must be done to read, see, and write	-Need reliable access to Internet -Respondent must be able to use a browser -Browser must support survey graphics -System can go down or be unreliable	-Need trained interviews -Need to make sure respondent is home -If using computer-assisted interviews, will need technical expertise to program them	Need trained interviews -Must find a suitable place to conduct interview
Special need	-Up-to-date address list -Follow-up mailings -Incentives	Space and privacy for respondent to complete the survey	-Technical expertise -Convincing method of ensuring privacy and confidentiality	-Up-to-date phone numbers -Schedule for reaching respondents -May need a sampling experts for random digit dialling -Incentive	-If-on-site, need space and privacy -May be difficult or dangerous to go to person's home
Costs	-Printing, paper, envelopes, stamps, incentives	-Printing, paper, incentive, survey supervisor, and possibly space for respondent to work	-Mainly technical (e.g. someone who is experienced in designing online surveys)	-Training, incentives, telephones and telephone charges, computers and technical expertise, sampling expert, incentives	-Training, space, travel, incentives

Source: Adopted from Fink (2006:9)

In this section, weaknesses based on practical and technical considerations are considered. One weakness of survey research is very low response rates. Many authors suggest that the response rates need to be improved (Pinsoneault and Kraemer, 1991; Sekaran, 2000; Fink, 2006). The support of top managers could be used to encourage participation at lower levels in the organisations (Forsythe, 1977). The author also added that the response rate was increased by personalization of the survey; in that company the chief officer identified potential participants. Sending the survey with the professional associations' logo on the questionnaire is also suggested as a technique to increase participation and response rates (Fink 2006). The short and simple-as-possible design of questionnaire is a method to improve participation and response rates (Fink, 2003a; Sekaran, 2000). The follow-up letters and distribution and collection of questionnaires by the researchers or their assistants rather than through the mail are techniques to help fix the response rate weakness of survey research. Sekaran (2000) suggests the follow-up letters with self-addressed, stamped return envelopes and keeping the questionnaire brief can be used to improve the rates of response to mailed surveys. Internet surveys might be another technique to increase response rate, especially when the surveys are dealing with people working directly with computers with internet access (Fink, 2006).

Therefore, the researchers need to develop a good format and content. The perfectly designed questionnaire is hard to find (Litwin 1995). However, it is generally accepted among researchers that pre-testing can reduce the errors.

In addition, the survey method is the most common approach to study characteristics and interrelationships of sociological variables (Roberts, 1999). The majority of studies in information quality has used the questionnaire survey method (Wang and Strong, 1996; Huang et al., 1999; Lee et al., 2002, Khalil and Elkordy, 2005; Shankaranarayanan, Evan and Watts 2006). Consequently, the questionnaire survey is thought to be most appropriate method to gain data in this study because the population consists of department managers in Thai companies listed on the Stock Exchange of Thailand.

4.2.2 Participants in the study

In the first survey, the participants of the survey are the top managers and the departmental managers in Thai organisations. The managers came from ten major departments which are marketing and customer relationship management, financial, purchasing and logistics, inventory, production and production planning, human resources, accounting, and

management information system. The second phase is the second survey, using a mailed questionnaire, to gather the information from Thai organisations. Participants in this study are the purchasing department managers in Thai manufacturing companies listed in the SET.

4.3. Data Collection

In this study, the data were collected from two surveys. The first survey is the preliminary study by administered questionnaires (see Appendix A). The second survey is conducted by mailed-out questionnaire (see Appendix B).

4.3.1 The first survey

The main purpose of the first survey is to gather data about the real situation of information in Thai organisations (Sekaran, 2003). As it is sometimes difficult to distinguish an administered questionnaire from an interview, approval was obtained from the University's Ethics Committee to administer the questionnaire as if it were an interview. During the interview, all participants were to be asked for permission to allow voice recording with an mp3 recording device. The audio interviews were suggested because they can be later transcribed for close analysis (Holstein and Gubrium, 1995). During the interview, participants were to be questioned for 30-40 minutes.

In the interview guide, the items are mixed between open-ended items and forced-choice items. The open-ended questions suggest giving respondents an opportunity to state a position in their own words but those words may be difficult to interpret (Fink, 2006). Closed-survey questions are mixed between yes and no responses and check lists. The check-lists questions ask for one or more than one answer within some check lists. A two-page questionnaire was designed for use with the top management which contained items about overview information relating to the company values, missions and the use of enterprise information systems (See Appendix A: top manager questionnaire). A second interview guide was designed to be used with departmental managers. The items in the second guide are related to departmental managers' responsibilities, decision-making, their attitude towards the quality of information they used from the current information system, subjects of decision in the departments, the availability of information to support the decisions and some characteristics of information such as frequency of use, the role of information in making decisions, sources of information, format and problems with the information currently

available (See Appendix A: department manager questionnaire). The conduct and results of this survey are reported in Chapter 5.

4.3.2 The second survey: mailed questionnaire

The second survey of this study was planned to gather the attitudes of Thai departmental managers towards the organisations' enterprise information systems in two aspects: the information quality; and type of information provided by the systems.

4.4. Design of survey instruments

The theoretical material in this section relates to both the first and second surveys. The processes of survey design are extremely important in conducting survey research. The advantage of a questionnaire survey is the ability to reach a wide population but the type of question and choice of alternatives may be a limitation as well as the content, wording, order and format.

In this study, the majority of items/questions in the second survey questionnaire are forced-response choice. Closed questions with several choices are easier to score than are open-ended, short answer, essay questions (Fink, 2006).

4.4.1 The second survey questionnaire

The first draft questionnaire was based on the literature review chapter and the items in previously published questionnaires and existing questionnaires within the information quality and Thai organisation studies. The written questionnaire consists of 12 questions (in 3 sections).

Section 1 was designed to seek characteristics of the participants. Therefore, questions 1.1-1.6 are about the personal information of participants, such as gender, age, country where degree obtained, education level, years of experience in current position and level of management. Question 1.7 asks the industry group of the company. The next question (question 1.8) asks the type of information software used to produce the decision support information.

In section 2, question 2.1 asks about the types of information available from the current enterprise information systems to make buying decisions. The 23 types of information suggested to be useful in buying decisions from the current enterprise information system will be examined by use of the seven-point Likert scale to measure the level of availability of types of information from 1 = not at all to 7 = completely available.

In Section 3, questions concern the quality characteristics of information useful to decisions related to buying. Question 3.1 is concerned with the quality characteristics of information that can be found from the buying related information produced from enterprise information systems. The quality characteristics of information were presented in a seven-point Likert scale from 1= not at all to 7 completely.

Question 3.2 involves the quality characteristics of information purchasing managers think they need in their buying decisions. The quality dimensions used in this section are adopted from the InfoQual framework of Price and Shanks (2005) which comprises 18 quality dimensions.

The survey package consists of an invitation to participate letter, an information sheet, instructions to complete the questionnaire, questionnaire and a pre-paid envelope. All the documents in the package were translated into Thai by one of the researcher's team who was born and educated in Thai then proof-read and edited by Thai and English staff from the Faculty of Business, Chiang Mai University in Thailand to make sure the content is understandable and well translated. Finally, all the material was proof-read by a Thai colleague who does not have a technical background in business and information technology, in order to test the understanding of the content.

The process of preparing and mailing-out took about 2.5 weeks to complete. The questionnaires were posted from Launceston, Australia by airmail service of the Australian Post which takes about 7-14 days to reach Thailand and the completed questionnaire from the participant were to be posted back to Launceston, Australia by Airmail service of the Thailand Post. There is a post-paid envelope in each survey package.

A total of 246 survey packages was mailed to 246 large Thai manufacturing companies based on the addresses obtained from the SET database. The first 181 survey packages were completed and ready to mail-out on 26 August 2009 and the second lot of 65 packages was mailed-out on 1 September 2009 because of shortages of Thai stamps. The 246 recipients were to be reminded via postcards 2 weeks after the date that the survey packages were mailed-out.

4.4.2 Scaling and scoring

A rating scale is an interval scale which measures data collected by the survey questions. It provides a straightforward way of asking attitudinal information that is easy and versatile to analyse and that provides comparability across time. The scale has to make sense in terms of

the survey's specific objective. De Vaus (2002) explains that a scale consists of answers to a number of questions. The score is assigned to particular answers depending on how favourable the answer is to the attitude being measured. There are several types of summated scales such as Thurstone scales, Guttman scales and Likert scale (De Vaus 2002), Semantic differential scale, Staple scale (Brace, 2004). The Thurstone and Guttman scales have become less common in recent years (De Vaus, 2002). Likert, Semantic differential and Staple scales methods are popular ways to seek responses to a series of attitudinal dimensions in survey research (Litwin, 1995; Brace, 2004).

The Likert scale is initially assigned through a process that calculates the average index score for each item in an index and subsequently ranks them in order of intensity. De Vaus (2002) suggests that 5- to 7- point scales are adequate for the majority of surveys that use ordered responses but probably use 4- to 5- point scales with self-administered questionnaires and telephone interviews. However, the choice of scaling is dependent on the survey's needs.

In scaling, De Vaus (2002) mentions four complications of scales which are; interpreting scale scores, equivalence of items, forcing scales to have meaningful upper and lower limits, and the problem of missing data. A problem with the scaling is the missing data. He suggests a number of ways of dealing with the missing data problem such as excluding cases with missing data on any of the scale items from the analysis, substituting valid values for missing values and adjusting for the number of items with valid codes. The author believes that the missing data problem is easily managed with a program such as SPSS.

The 7- point Likert scale questions will be used in this study design which provides the data to be analysed in frequency, standard deviation and median statistics.

The mean scores calculated from the questionnaire were interpreted as abundant (6.50-7.00 mean score); plentiful (5.50-5.49 mean score), somewhat plentiful (4.50-6.49 mean score); average (3.50-4.49 mean score); somewhat scanty (2.50-3.49 mean score), = scanty (1.50-2.49 mean score), absent (1.00-1.49 mean score)(Young and Jamieson 1999).

4.4.3 Variables

The items in the questionnaire were asked to gather several variables from all respondents. These variables can be classified into 3 main categories; two in each of demography, type of information and quality of information. The links between the variables and the questionnaire are presented in Table 4.2.

Table 4.2 Variables determined in a main survey questionnaire

Category	Variable determined in a questionnaire	Question
1	1. Demographic data of respondents(managers)	1.1-1.5
	Gender	
	Age	
	Education level	
	Country of degree obtained	
	Year of experience in current position	
	2. Demographic data of organisation	
	Company size	1.6
	Company's Industrial group	1.7
	Demographic data of Information System	1.8
2	The availabilities of purchasing information from current enterprise information system	2.1
	Types of purchasing information managers need in decision-making	2.2
3	Information quality criteria that managers needed	3.1
	Information quality criteria available from current enterprise information system	3.2

Source: generated from questionnaire

The first categories related to demography of respondents, company characteristics and current enterprise information system characteristics. The second category comprises variables involving the availability of the types of purchasing information and types of purchasing information that managers need in their purchasing decision-making. The first part of the third category relates to the quality of information in the aspects of the ideal quality needed by the managers. The other part of the third category relates to the quality of information currently available from the enterprise information system. The variables from the second and third categories were used to test the propositions. The linkages of questionnaire items to the proposition are shown in Table 4.3.

Table 4.3 The linkages of questions to the propositions.

Proposition	Questions in the questionnaire related to the propositions.
1	3.1 Set of information quality criteria that managers needed 2.1 Types of purchasing information available from current enterprise information system
2	2.1 Types of purchasing information available from current enterprise information system 3.1 Set of information quality criteria that managers needed 3.2 Set of information quality criteria available from current enterprise information system
3	2.1 Types of purchasing information available from current enterprise information system 3.1 Set of information quality criteria that managers needed 3.2 Set of information quality criteria available from current enterprise information system

Source: generated from questionnaire

4.4.4 Survey instruments translation process

The language and wording of questionnaires have become major issues in questionnaire design. The language of the questionnaire should approximate the level of understanding of the respondent (Sekaran, 2003; Bourque and Fielder, 1995). Sekaran (2000:242) states that

> *It is important to ensure that the translation of the instrument to the local language is equivalent to the original language in which the instrument was developed.*

This study is cross-cultural research in which the processes of study are conducted in the English language but the data are gathered in Thailand. Therefore, the language barrier is one of the limitations of the study, as Thai is the first language in Thailand. This leads to all

survey instruments being translated into the Thai language before being used in the survey process.

The interview guides for the first survey were constructed in English and approved by University of Tasmania Human Research Ethics Committee. They were then translated into Thai by the researcher and audited by Dr. Sarapaiwanich, PhD. in Accounting, University of New England, Lecturer at Department of Accounting, Faculty of Business Administration, Chiang Mai University before making copies to use in the interviews.

Similarly, the second survey questionnaire was developed in English. Then, it was translated into Thai and audited by two Thai academic staff in Department of Management, Faculty of Business Administration, Chiang Mai University who have expertise in management and management information systems backgrounds. They also are fluent in English and Thai. Then the document was proof-read by a Thai colleague who does not have technical background in business and information technology to test the understanding of the contents. After an audit of the translation process, the questionnaire will be copied and distributed to participants.

4.4.5 Reliability and validity of survey instrument

This study applies a mixture of test-retest and alternative-form reliability together with internal consistency reliability on the self-administered questionnaire in order to evaluate the reliability of the instrument before use in the second survey.

The reliability testing of items and scales of the survey instrument suggests providing quantitative measurement of how well an instrument performs in a given population (Litwin, 1995). The test-retest reliability is the most commonly used indicator of survey instrument reliability. In test-retest, the correlation coefficients or r-values are calculated to compare the two sets of data collected from the same respondent in different periods of time in order to check reliability of variables that are unlikely to change over the short period (Litwin, 1995). The alternative-form reliability is tested by rewording or reordering of the tested survey instrument to produce two different versions that are similar but not identical. The alternative-form reliability mixed with the test-retest technique is applied to reduce the practice effect that might exist in the test-retest method. The internal consistency reliability checks the reliability of a set of information questions in the self-administered questionnaire by Cronbach's coefficient alpha, a statistical measure used in the internal consistency reliability test. Even though reliability assessments are recommended for all surveys they are

not sufficient when examining the psychometric properties of a survey instrument, so the validity assessments are also compulsory to assess a survey instrument (Litwin, 1995). Litwin (1995) described validation assessments determine the reliability of a survey item and the scale. It measures how well the survey instrument measures what it set out to measure. Several types of validity apply to the performance of a survey instrument such as face, content, criterion and construct. Face validity is based on a cursory review of items by untrained individuals to see whether they think items look fine to them and content validity is not quantified with statistics but is presented as an overall opinion of a group of trained judges. In this study, the face validity was examined by asking two Australians to complete the questionnaire. The content validity was assessed by testing the questionnaire with an information system developer and an information user from the University of Tasmania. He also mentioned that the criterion validity is a measure of how well one instrument stacks up against another instrument from published literature available in the area of study (Litwin, 1995). In this study, the criterion validity is examined by assessing the same variable of the questionnaire against the correlation coefficient statistic between the initial test and the secondary outcome. The construct validity test is more like hypothesis testing than like calculating correlation coefficients (Litwin, 1995).

4.4.6 Pre-testing

Pre-testing can help identify the strengths and weakness of survey questions, format, wording and order. The pre-testing or pilot testing is the technique to prove the questionnaires and to identify the errors in a survey's form and presentation before using the questionnaire in the survey process (Litwin, 1995). He states:

> *Pre-testing is a necessary and important part of survey development. It provides useful information about how your survey instrument actually plays in the field. Although it requires extra time and energy, the pilot test is a critical step in assessing the practical application of your survey instrument (p.67).*

Many possible issues were identified during the pre-testing such as problems of form and reading comprehension. The pre-test provided a chance to correct these errors, thus avoiding difficulties that may arise during subsequent data collection (Litwin, 1995).

Prior to its mailing, the questionnaire was pre-tested to improve and validate the survey, and determine the most appropriate length of the survey. Two hard copies of the English version questionnaire were handed to two PhD candidates, one Jordanian and one Australian in the

School of Accounting and Corporate Governance and the Thai version of the questionnaire was sent via electronic mail to three Thai native speakers who have a background in management and accounting. This confirmed that the estimate of the time required was reasonable and that the questions were suitable for the interested audience. Some questions were modified to satisfy their comments before being process and mail out.

4.4.7 Sample

The sampling process is conducted to determine how many participants will be sufficient to represent the characteristics of the population as a whole (Sekaran, 2000). The selection of sample is dependent on the requirements of the project, its objectives and the funds available (Cooper and Schindler, 2001).

The purpose of this study is to discover the available information from current enterprise information systems of Thai organisations and how well that information meets the decision-making needs of managers in those companies. The purchasing managers in Thai manufacturing organisations are the population of this study. However, the population was scoped down to the purchasing managers in potential EIS adopting companies which were suspected to be large organisations. This is because the large organisations are suspected to have complex communication systems, clear management patterns, clear organisations' structure and operated with professional teams rather than the small and medium organisations. Due to this, the survey was confined to the Thai manufacturing companies listed on the Stock Exchange of Thailand (SET). SET reports the 559 securities trading in June 2009 which includes 22 Property funds, 10 unit trusts and 53 companies in MAI (Market of Alternative Investment) (The Stock Exchange of Thailand, 2009). The number of 496 companies was reported and categorised into 11 groups as in Table 4.4.

Table 4.4 Number of securities of the SET categorised by Industrial groups.

Industrial group	Total
Agro and Food Industry	43
Consumer Products	41
Financials	(61) Excluded
Industrials	70
Property and Construction (Excluded22 Property funds)	89
Resources	27(Excluded 1 medium-size company)
Services	(86) Excluded
Technology	37
Companies Under Rehabilitation (NPG)	(19) Excluded
Market of Alternative Investment (MAI)	(53) Excluded
Unit trusts	(10) Excluded

Source: generated from Stock Exchange of Thailand (2009)

This is no official definition of large companies in Thailand. However, there is a definition of small and medium size organisations issued by the Thai government. Therefore, the

organisation which is not matched with the definition of the SME is recognised as a large organisation in this study. The institute of Small and Medium Enterprise Development provides the definition of SME organisation in manufacturing as shown in (Table 4.5) and production organisation means agricultural processing, manufacturing, and mining.

Table 4.5 Definition of small and medium enterprise

	Small organisation		Medium organisation	
	Total asset	No. Employee	Total asset	No. Employee
Production organisation	< 50 million baht	< 50	< 200 million baht	50-200

Source: adopted from the institute of Small and Medium Enterprise Development (2008)

Only six industrial groups are considered to be manufacturing organisations. They are Argo and Food Industry, Consumer Products, Industrial, Property and Construction, Resource and Technology which comprise 308 companies. The list of 308 companies' names, contact detail and industrial groups were obtained from the SET website in electronic form. Lastly, the companies' fixed assets values were obtained from the SET website on 20 June 2009 which provided data which was up-to-date as of 1/03/2009 (first quarter of 2009). After the process of retrieving net fixed assets of each company, there were 260 large companies which have total fixed assets value more than 200 million Thai Baht (THB).

4.4.7.1 Calculation of the sample size

De Vaus (2002) suggests that the sample size depends on two key factors: the degree of accuracy required for the sample and variation of the key characteristics of the study. In this study, the industrial group is used as a key characteristic of the study.

Proportion = $$n = \frac{Nk^2PQ}{k^2PQ + NE^2} \quad ; \quad n_{rel} = \frac{Nk^2Q}{k^2Q + NPE^{'2}}$$

The population of this study (N) comprises 265 large manufacturing companies in SET. The k-value is 1.96 and the proportion of the population interested (Q) is 0.5(α = 5 %.). The confidence interval is 0.10. The sample size was calculated based on the value of confidential level (Z) at 95 %, percent of picking sample(p) at 0.5, confidence interval (C) = ± 10 and population (p) at 265. The appropriate sample of participants is 200 and the desirable response rate of this study is about 70 companies out of 265 which will be 35 percent of response rate.

4.4.7.2 Sampling methods

The population of this study is large Thai manufacturing organisations. The sample of large Thai manufacturing organisation was acquired from the SET website. To make sure the sampling of this study is well representative of the population, the probabilities sampling method was used to draw the sample (Fink, 2003c).This study used the stratified sampling which is the modification of the systematic sampling. First, the population was divided into sub-groups or strata which are the six industrial groups categorised by SET. Then, the proportion allocation was calculated for the desirable number of sample from each industrial group (Table 4.6). The list of random sampling was generated by using http://www.randomizer.org/form.htm.

After getting the random number list the sample was identified from the list of population provided from SET website. To make sure that the addresses and contact details were valid, the process of validating the contact detail and postal addresses was performed by phone calls before producing the final postal list of the sample.

Table 4.6 Sampling calculation

Industrial group	Number	proportion	Number of sample draw
Agro and Food Industry	43	17%	30
Consumer Products	29	11%	20
Industrials	62	24%	43
Property and Construction (Excluded22 Property funds)	71	27%	50
Resources(Excluded 1 medium-size company)	26	10%	18
Technology	29	11%	20
Total	260	100.0%	182

Source: generated from Question 1.6 (Industrial group)

4.5. Rules on Ethics and Confidentiality

The University of Tasmania insists that all data collection activities be approved by the Ethics Committee. Approval for the first survey was granted on 29 November 2006. Approval for the second survey was granted on 24 August 2009. Those approvals relate to confidentiality and anonymity of participants, protection of the data collection, the nature of the questions and storage.

4.6. Data analysis techniques

The data gathered from the two surveys were analysed using two different techniques.

4.6.1 Analysis of the first survey

The transcripts of interview passed the process of proving correctness of the transcription from Thai to English from Dr. Sarapaiwanich, Lecturer at Department of Accounting, Faculty

of Business Administration, Chiang Mai University before the English versions were proof-read by Professor Victoria Wise. The transcripts of the First surveys were categorised into tabular form and coded. Sekaran (2003) suggests that the interview data may be tabulated and then coded. Then, the data in tabular form were analysed as frequencies and percentages.

4.6.2 Analysis of the second survey

The second survey is based on the mailed questionnaire. The quantitative data will be analysed using the Statistical Package for the Social Sciences SPSS version 17. A range of statistical procedures is to be adopted to explore the research questions posed and to test the propositions. After the filled questionnaires are returned from the participants, the data gathered from the questionnaires of the second survey will be entered into the SPSS. After the data entry phase is finished, the descriptive statistical analysis including means, medians, frequencies and standard deviations function of the SPSS software will be used to generate the results for this study. The data tables from the analysis phase will be discussed in Chapter 6: Second Survey- the Results, Findings and Discussion.

4.6.2.1 Information Quality

The frequencies are tools suggested to support information quality analysis (Huang et al., 1999). The means, standard deviations and confidence intervals as the descriptive statistics are used to assess the quality of information in many studies (Najjar and Schniederjans, 2006; Wang and Strong, 1996). The Cronbach alpha is used to indicate the consistency among the questions (Shankaranarayanan et al., 2006; Wang and Strong, 1996). In this study, frequency distributions will be utilised to describe the information quality data in terms of nominal scales.

A Chi-Square technique will be employed to demonstrate the relationship between two variables, which are nominal scale such as the information quality and type of current enterprise information system.

The mean measures of ideal characteristics of information quality in the managers' point of view data and the characteristics of information quality from the current enterprise information system will be compared to identify the gap between these two perspectives.

4.7 Summary

This chapter outlined the research methods used in the study. The method chosen to conduct this study is the survey method as it is a widely adopted method in information quality studies

and suitable for the study environment. The weaknesses of the survey method were controlled by several techniques suggested from the literature such as pre-testing and testing reliability and validity of the survey instruments.

This study was conducted using two surveys. The first survey is to gather data about the real situation of information from the top management and the departmental managers in Thai organisations. The results from the first survey were combined with relevant information from the literature review to form the second survey questionnaire. The second survey was planned to gather the attitudes of Thai departmental managers towards the organisations' enterprise information systems in two aspects: the information quality and type of information provided by the systems which will be used to answer the research questions and test of the propositions of the study.

In Chapter 5, the results from the first survey will be presented and the analysis and the results of the second survey in Chapter 6.

Chapter 5

First survey

5.0 Introduction

The first survey was conducted among Thai organisations during November 2006 and December 2006 in order to gather data about the use of information. The data from the first survey will be used to design the questionnaire for the second survey. Before doing the interview, interview question design and ethics approval were arranged (see Appendix A). The tools in this first survey were the two interview questionnaires that were designed to collect the data from the top management and the departmental managers in Thai organisations. This two-page questionnaire contained questions about overview information about the company values, mission and the use of enterprise information systems. The second questionnaire was designed to ask departmental managers about their responsibilities, decision-making within their positions, their attitude towards the quality of information they had from the current information system, subjects of decision in the departments, the availability of information to support the decisions and some characteristics of information such as frequency of use, the role of information in making decisions, sources of information and the format and any problems with the currently available information(see Appendix B). The approach used in the first survey was an interview with a CEO and 24 departmental managers of four Thai organisations. The sample was chosen from the population of listed companies in the Stock Exchange of Thailand (SET).Only two public companies participated in this study so the two state-owned enterprises were also selected.
The documents for the interviews were created in English and approved by University of Tasmania Human Research Ethics Committee then translated into Thai.

5.1 Profiles of questionnaire respondents

Four organisations participated in this interview process (Table 5.1); two state enterprises and two public companies. These interviews were held during the period 10 November 2006 to 25 December 2006 in Bangkok, Thailand. Before the interview, all participants were presented with an information sheet and consent form. The interviewees were asked to sign the consent form prior to the interview being conducted. Interviewees were also asked to consent to voice recording of the interviews.

Table 5.1 Organisations participating in the interview process

Type of Organisation	Manufacturer	Service	Total
State Enterprise (SE)	1	1	2
Public Company (PC)	2	0	2
Total	3	1	4

Source: generated from the first survey data

The adoption of information systems in the four sample companies is presented in Table 5.2. One state enterprise had adopted the full integrated SAP system in all organisational functions but some managers used Microsoft Excel to create their own reports while the other state enterprise adopted Oracle ERP system and also used non-ERP software for particular tasks; in addition, the managers mentioned that the firm will adopt a new enterprise information system, SAP, in the future. One public company has customised non-integrated information systems for each department but plans to adopt the SAP enterprise information system next year. One public company has adopted the full integrated Movex system and Microsoft Excel to create reports in their financial department, but is in the process of implementing Business Intelligence (BI) to produce management reports.

Table 5.2 Current and future plans for enterprise information system of participating organisation

Organisation	ERP	Non ERP	Future change	Integrate all business functions
SE1	Oracle	FT Pro, Excel Platinum, Microsoft Excel, Crystal report, ELCID	SAP	Yes
SE2	SAP	Microsoft Excel	-	Yes
PC1	-	Customise department system	SAP	No
PC2	Movex	Microsoft Excel	BI*	Yes

Source: Generated from the first survey data *Business Intelligence system

A top manager participated in the interview, and 25 managers from 8 departments of 4 enterprises were permitted to participate in this First survey. One organisation gave permission to interview ten managers from seven departments; another organisation permitted the interview of six managers from six departments; one organisation permitted the interview of seven managers from seven departments; and one organisation allowed the interview of two managers from two departments. The departments were Marketing and Customer Relationship Management, Financial, Purchasing and logistics, Inventory, Production and Production Planning, Human Resources, Accounting and Management Information System. These departments are listed in Table 5.3.

Table 5. 3 Number of managers participating in the interview group by organisation and department

Department Participating in interviews	Number of manager				
	SE1	SE2	PC1	PC2	Total
Top manager	0	0	1	0	1
Marketing	1	1	1	0	3
Finance	1	1	1	1	4
Purchasing and logistics	1	1	1	0	3
Inventory Control	0	0	1	0	1
Production Planning	0	1	3	0	4
Human Resource	1	1	1	0	3
Management information system	1	1	0	1	3
Accounting	1	1	1	0	3
Total	6	7	10	2	25

Source: generated from the first survey data

5.2 Departments' responsibilities

Table 5.4 Responsible tasks in marketing departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Product innovation	0	1	0	0	1
Marketing research and marketing Plan	0	1	1	0	2
Plan and management distribution channels	0	1	0	0	1
Customer care and support	1	0	0	0	1
Forecast customer need and sale target	0	1	1	0	2
Take Order and negotiate order detail	0	1	1	0	2
Establish business alliances	1	1	0	0	2
Provide product and service information/customer awareness	1	1	0	0	2
Marketing Projects/exhibition management	1	1	0	0	2
Participate in Customer's Auction to get order	0	1	1	0	2
Prices setting/Price List	0	1	1	0	2
Managing sale targets	0	1	1	0	2
Total	4	11	6	0	21

Source: generated from the first survey data

The responsible tasks in marketing departments of three organisations are presented in Table 5.4. To sum up; twelve responsibilities were reported as the major tasks of the departments. However, there is some difference between the state enterprises and public companies, especially in promotion, as the state enterprise tends to educate customers rather than encourage customers to buy more.

Table 5.5 Responsible tasks in finance departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Credit approve for customer and trading term	0	0	0	1	1
Foreign exchange forecast and management[1]	1	0	1	1	3
Dividends payment	0	0	1	0	1
Manage Budget	1	0	0	0	1
Bank and finance institutes management[2]	1	1	1	1	4
Acquire loan with financial institution	1	0	1	0	2
Capital investment[3]	1	0	1	1	3
Investment plan in company capacity and expand service	1	0	0	1	2
Projection report	1	0	0	1	2
Forward contract	1	0	1	1	3
Management Risk in investment	0	1	1	1	3
Manage Cash/Pretty Cash and Cheque	1	1	1	1	4
Manage Account payable and account receivable	1	1	1	1	4
Total	10	4	9	10	33

Source: generated from the first survey data [1] T/T =telegraphic transfer, T/R =Trust Receipt, L/C = Letter of credit;
[2] service/fee negotiation, allocation; [3] subsidiary company and stock market

Table 5.5 illustrate the responsibilities in financial departments of the four organisations. The financial departments in both state enterprises and public companies are mainly responsible for banking and cash management. In one state enterprise the financial department does not have the task of investing in the capital market and, in the same organisation, the foreign exchange task is not the responsibility of the financial department but of the logistic and purchasing department. In one state enterprise the financial department does not have the responsibility of risk management because the firm is in utility service. Only one public company is responsible for customer credit approval. The dividend responsibility is mentioned by one public company and another company mentioned that it is the responsibility of the CEO.

Table 5.6 Responsible tasks in purchasing and logistics departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Auction announcement	1	1	0	0	2
Set safety stock	0	1	0	0	1
Manage goods and services quality approve list	0	1	0	0	1
Check the stock remaining	0	0	1	0	1
Negotiate price	0	0	1	0	1
Vendor construction contract control	0	1	0	0	1
Manage foreign exchange[1]	1	0	0	0	1
Sign contracts or produce purchase orders	1	0	0	0	1
Manage purchase request from other department	1	0	1	0	2
Set the specification of purchase	1	0	1	0	2
Manage suppliers	1	0	1	0	2
Examine suppliers offer against specification	1	1	0	0	2
Insurance on purchasing or import	1	1	0	0	2
Set delivery date	0	1	1	0	2
Process purchase order	0	1	1	0	2
Set standard price list	1	1	0	0	2
Total	9	9	7	0	25

Source: generated from the first survey data [1] Letter of Credit

Table 5.6 illustrates the responsibilities of purchasing and logistic departments of three firms. The responsibilities in this department are commonly about the process of purchasing material for production, business supplies and fixed asset purchasing. However, one state enterprise departmental manager was responsible for managing the foreign exchange process instead of the financial manager. Moreover, she also selected the supplier according to the manufacturing standard adopted by the firm and international standard of industry.

Table 5.7 Responsible tasks in inventory departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Store purchased goods	0	0	1	0	0
Generate stock cards	0	0	1	0	1
Update stock cards	0	0	1	0	1
Process the withdraw request	0	0	1	0	1
Receive goods from vendor	0	0	1	0	1
Check physical levels of stock	0	0	1	0	1
Place purchase request when reach safety stock	0	0	1	0	1
Discharge destroyed goods	0	0	1	0	1
Store finished goods	0	0	1	0	1
Total	0	0	9	0	9

Source: generated from the first survey data

One manager was participating in the interview and the responsibilities of his department are presented in Table 5.7. Major responsibilities are managing raw material, work-in-process and finished goods.

Table 5.8 Responsible tasks in production and production planning departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Generate production plan from sale forecast	0	1	1	0	2
Calculate direct material quantity and labour hour needs	0	1	1	0	2
Calculate production capacity	0	1	1	0	2
Set production timetable	0	1	1	0	2
Generate production plan	0	1	1	0	2
Issue raw materials	0	0	2	0	2
Start the production process	0	0	2	0	2
Testing work in process	0	0	2	0	2
Send the finished good to inventory department	0	0	2	0	2
Request the machine maintenance	0	0	2	0	2
Supervision labour in production process	0	0	2	0	2
Total	0	7	17	0	25

Source: generated from the first survey data

The responsibilities of production and production planning departments of two firms' are shown in Table 5.8. The production planning department was responsible for the planning process; both a state enterprise and a public company adopted the bill-of-material in their production planning. Two production-line managers from one public company participated in this First survey and had the same responsibility in the product line which related to day-to-day management of raw material, labour management, work-in-process, production quality management and finished goods.

Table 5.9 Responsible tasks in human resource departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Generate job description and specification	1	1	0	0	2
Manage man power regarding the retire/resign/recruit process	1	1	0	0	2
Mange the recruitment	1	1	1	0	3
Set salary	1	1	1	0	3
Mange employee welfare	1	1	1	0	3
Set trainings programme	1	1	1	0	3
Set employee steering committee	1	1	1	0	3
associate with labour union	1	1	1	0	3
manage the promotion	1	1	1	0	3
Total	9	9	7	0	25

Source: generated from the first survey data

Three human resource managers from three organisations participated in the First survey, and their responsibilities are shown in Table 5.9. The responsibilities in human resources are recruitment, staffing, incentive management and promotion.

Table 5.10 Responsible tasks in management information system departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Set hardware specification	1	1	0	1	3
Set software and application specification	1	1	0	1	3
Manage hardware and software support to end user	1	1	0	1	3
IT master plan	1	1	0	1	3
Generate action plan	1	1	0	1	3
Set Priority of software implementation	1	1	0	1	3
Operate database management	1	1	0	1	3
Operate back up procedure	1	1	0	1	3
Generate managerial information	1	1	0	1	3
Manage software implement project management	1	1	0	1	3
Total	10	10	0	10	30

Source: generated from the first survey data

Table 5.10 shows the responsibilities in Management Information System departments. The Management Information System managers of three firms which had adopted integrated enterprise information systems had responsibilities in planning, managing the hardware and software information technology resources of the firms. Three managers reported that they have the same responsibilities regarding department management.

Table 5.11Responsible tasks in accounting departments

Responsible tasks	Frequency				
	SE1	SE2	PC1	PC2	Total
Accounting report for support strategic planning	1	0	0	0	1
Cost accounting	0	1	1	0	2
Choose accounting standard and alternative in practicing	1	1	1	0	3
Produce the managerial information	1	1	1	0	3
Close account balance and prepare financial accounting report	1	1	1	0	3
Give advice how to use accounting data and information to executive	1	1	1	0	3
Day to day transaction recording	1	1	1	0	3
Budgeting	1	1	1	0	3
Total	7	7	7	0	21

Source: generated from the first survey data

Table 5.11 shows responsibilities in the accounting departments of three organisations. All managers had the same responsibilities in recording and producing the financial accounting report. However, one state enterprise accounting department claimed to produce accounting reports to support the strategic planning of the organisation. The same state enterprise, which is service organisation, does not have responsibilities for the cost accounting task.

5.3 Decision issues in Departments

In this First survey one objective was to gather information about decision making in departments. During the interviews, many managers mentioned that most of the decisions were made by the top management rather than by the departments. However, most of them mentioned that they could not identify the issue of decisions which resulted in the data collected in this section being limited.

Table 5.12 Decision issue of marketing managers

Decision issue	Frequency				
	SE1	SE2	PC1	PC2	Total
Order acceptance	0	0	1	0	1
Sale Forecasting	0	0	1	0	1
Pricing	0	1	1	0	2
Shipment date	0	1	1	0	2
Total	0	2	4	0	6

Source: generated from the first survey data

The decision making issues in the marketing department are related to the trading processes which are order acceptance, sale forecasting, pricing, shipment date, as shown in Table 5.12.

Table 5.13 Decision issue of finance managers

Decision issue	Frequency				
	SE1	SE2	PC1	PC2	Total
Risk and return evaluation	0	1	1	1	3
Select the best offer financial institute services[1]	1	1	1	1	4
Select capital investment sources[2]	1	0	0	1	2
Total	2	2	2	3	9

Source: generated from the first survey data[1] Loan, Deposit and [2] Own money or loan

The financial managers responded that their decision issues related to risk management, investment management and choosing the services from financial institutions as presented in. Table 5.13.

Table 5.14 Decision issue of production and production planning managers

Decision issue	Frequency				
	SE1	SE2	PC1	PC2	Total
Work Over-Time	0	0	1	0	1
Replace machine	0	0	1	0	1
Usage of machine and product line	0	0	1	0	1
Total	0	0	3	0	3

Source: generated from the first survey data

Decision making issues in the production and production planning departments are related to work force management and machine usage, as presented in Table 5.14.

5.4 Information issues

Table 5.15 Missing information problem in departments

Organisation	Department	frequency
SE1	Marketing	Y
SE1	Purchasing	Y
SE2	Marketing	Y
PC1	Finance	Y
PC2	Finance	Y
Total		5

Source: generated from the first survey data

Table 5.15 shows the data about missing information in decision making mentioned by managers participating in the First survey. Only five managers reported that they experienced problems due to the lack of information.

Table 5.16 Information problems in departments (Y = Have problem)

Organisation	Department	Delay	Overload	Quantity	Reliable	completeness	Own System	Data not up to date	Total
SE1	Marketing			Y					1
	Purchasing			Y	Y	Y	Y		4
	Human Resource								0
	Accounting	Y							1
	Finance								0
	MIS								0
SE2	Marketing	Y	Y	Y				Y	4
	Purchasing	Y	Y						2
	Production Planning	Y							1
	Human Resource						Y		1
	Accounting	Y				Y	Y		3
	Finance								0
	MIS								0
	Inventory Control								0
	Production /Factory								0
PC1	Marketing								0
	Purchasing								0
	Production								0
	Planning								0
	Human Resource								0
	Accounting								0
	Finance			Y			Y		2
	MIS								0
PC2	Finance	Y		Y					2
	MIS						Y		1
Total		6	2	5	1	2	5	1	22
percentage		24	8	20	4	8	20	4	4

Source: generated from the first survey data

Table 5.16 presents the information problems in each department of four organisations. The major problem (24%) is the delay of information. Five managers (20%) reported the quantity of information as a problem. The reliability of information and data not up-to-date were reported by the marketing manager of one state enterprise. One in five departmental managers participating in this First survey reported that they create their own information systems even though they had already adopted the enterprise information system or the department had an operating information system.

5.5 The limitations of the First surveys

The limitations of the First survey are timing and ability to access to sample. During the First survey period only two Thai public companies were interested to participate in this study. However, the researcher had opportunities to access two large state-owned enterprises' management teams.

5.6 Summary of First Survey and its Influence on the Second Survey

The data generated by the first survey indicated the number and nature of responsibilities/duties of the departments which responded. That survey also yielded some data about the systems being used to collect and to process information and some indications of the nature of the information likely to be required. In addition, there were some suggestions of dissatisfaction with the information available from existing systems.
As noted in the reporting and discussion of the results of the first survey, those results guided the selection of the department to be investigated in depth and the design of questions seeking to discover managers' views on relevant information and its quality.

Chapter 6

Second Survey -The Results, Findings and Discussion

6.0 Introduction

As stated in Chapter 4, survey packages were sent to 246 large Thai manufacturing firms listed on the Stock Exchange of Thailand (SET). Seventy-nine questionnaires were returned. Among the returned questionnaire, seven returned questionnaires were considered ineligible to include in the analysis because they did not answer most of the questions and ten prospective participants reported loss of the survey packages. The response rate of this study is 31.44 percent which is considered to be satisfactory in survey research. To ensure the sample represents the population of the study, the external validity test was performed using non-response bias analysis. The standard early/late response test was applied and there was no significant difference. In this chapter, the data from the second survey are reported in tabular form using frequency, mean and percentage. Then, the data are analysed to find relationships among variables with sample-pair t-test and One-way ANOVA test.

6.1 The second survey

After a five-page questionnaire and related documents were approved by the Ethical Committee, University of Tasmania, the survey packages were produced and prepared. Each survey package contains a cover letter providing general information about the survey and reasons to motivate the respondents to complete the questionnaire in a one-page document on official school letter head, an information sheet, a questionnaire and a Thai stamped pre-paid envelope pre-addressed to return to the Australian collection base. The first lot of 181 survey packages was mailed out on 28th October, 2009 and the second lot of 65 survey packages was mailed out on 1st September 2009 because of the shortage of Thai stamps. The participants were asked to complete and return the questionnaire by 25th September 2009. On 25th September 2009, the follow-up letters were printed and mailed to all non-returning recipients to reinform them about the importance of the survey to the research and encourage them to complete and return the questionnaire. The follow-up letters were simply printed in one-page

on official school- letterhead, folded and stapled before posting. The follow-up letters were distributed through Thailand Post Company which reduced the arrival time to the respondents.

6.2 The return of questionnaires

The completed questionnaire started to arrive at the collection base in the University of Tasmania on 9th September 2009. Although, the due date stated on the questionnaire is 25th September 2009 the cut-off date of this study was set to be the 7th October 2009 because the survey packages and the returned questionnaires were subject to the delays in the international mail system from Thailand to Australia.

6.2.1 The response rate

By the cut-off date, 79 questionnaires were returned. Some of the returned questionnaires were inspected by the Australian Customs for some quarantine items. All survey researchers hope for a high response rate but, in fact, the response rate depends on many uncontrollable factors (Fink, 2003c). The sample and participant details are presented in Table 6.1.Ten purchasing managers who responded via an email to inform that they did not receive any survey packages were recognised as unreachable. Among the returned questionnaires, seven returned questionnaires are ineligible as the respondents did not answer the question on type of current enterprise information system, many items in required information types and many items of quality of information available section. There are several methods to calculate the response rate of the survey and no single response rate is considered standard (Fink, 1995). De Vaus (2002) commented that the Paper and Pencil base mail questionnaire (PAPI-based) mail surveys can encounter greater response problems. The response rate of this study was calculated by the formula available in Figure 6.1 based on the N in sample = 246; ineligible respondents = 7; unreachable respondents = 10; actual returned = 72 and response rate is 31.44 % (Table 6.1). The response rate of this study is considered low due to the limitation of time and budget to perform the second survey to increase the response rate. However, the response rate is considered acceptable but non-response bias analysis needs to be conducted before the data and analysis can be used (The National Center for Education Statistics, 2002).

Figure 6.1 Response rate formula

$$\text{Response Rate} = \frac{\text{Number returned}}{\text{(N in sample- (ineligible + unreachable)}} * 100$$

Source: Adopted from The National Center for Education Statistics, 2002

Table 6.1 Respondents and response rate

Total	Sample	Respondents	Percentage
Postal	246	79	
(-)Ineligible respondents	7	7	
(-)Unreachable	10		
Actual	229	72	31.44

Source: Data are drawn from the survey

6.2.2 Data Collection Problems

In this study the data collection problems can be described in two stages: mailed-out and waiting for returning stage; and after return of the questionnaire stage.

At mailed-out and waiting for returning stage, some survey problems had been discovered which are:

1. the loss of questionnaire packages during the mail- out process; and.
2. delay of the postal system.

However, there was some concern about the mail-out of the survey packages because the survey packages were sent off by two international mail services which involved Australia Post and the Thailand Post. Delay of delivery was expected to occur as well as missing mail as the result of the use of existing database of SET which normally contains the head office of the companies rather than the purchasing department direct address. The process of checking the original list address by phone was conducted but only 181 companies from 246 were be able to contacted . This ensured that 181 survey packages reached the respondents. This problem is confirmed by a couple of e-mails from respondents about undelivered survey packages after the follow-up letters were sent off. The identification numbers were applied to the returned envelopes and the delivered returned envelopes were deleted from the follow-up letter list. The problem about lost questionnaire packages was discovered after the reminder letter was mailed out and reached the prospective participants. Ten purchasing managers responded via e-mails to the address located in the school letter-head form to inform that the survey packages had not reached them. All ten prospective participants were acknowledged with a thank-you note and a request for permission to send the electronic form of the survey package. However, none of the electronic forms of the questionnaires was returned. Another possible reason is the wrong address. This study relied on the companies' addresses recorded by SET and regarding the requirement by the ethical committee that the survey package be addressed to the personnel department asking them to distribute the package to the purchasing manager of the company. Both of these constraints increased the possibility that the survey package would not reach the purchasing managers.

After the mail-out of the reminder letter, three participants sent e-mails to inform that they would respond and send off the questionnaire with the detail of date of return. This is because the mail-out survey package and returned questionnaires depended on two international postal systems which are Thailand Post Company Limited and Australian Post via the airmail system that takes about 10- 20 days to be delivered to the destination; unlike the reminder letters which were processed in Thailand and could reach the participant in 2-7 days.
After the return of the questionnaire, a couple of problems occurred:

3. missing data in the respondent's questionnaire; and
4. non-response bias

Missing data are a common problem with the questionnaire instrument. In this study, some respondents did not complete some questions. Some items in types of information in the buying decision section were ignored, some managers did not know some types of common information suggested to be useful from academic and trade organisation journals, especially the strategic type of information. However, those questionnaires are used for data analysis of this study but the missing answers have been noted.

6.2.2.1 Non-response bias analysis

The survey method has the ability to make statements about larger groups from smaller samples. The researcher cannot appropriately assume the result from a smaller sample to predict some attribute of the larger target population without external validity (Bartlett, Bartlett and Reio, 2008). The non-response bias analysis helps to check the external validity of the study. The analysis can be handled in many ways such as comparing non-respondents to population, comparing respondents to population, comparing early and late respondents, etc. Bartlett et al., (2008:46) state that "survey non-response bias refers to the possible bias introduced into a study when non-respondents differ systematically from the respondents in one or more ways".
In this study, the non-response bias was tested by comparing company characteristics of early and late respondents using compared means independent-sample t-test. The early and late respondents were grouped using the date of return on postal date stamp by Thailand Post which the early respondent is the respondent from 9th September 2009 to 25th September 2009 and the late respondent refers to the respondent from the period of 26th September 2009 to 7th October 2009.The statistical data are provided in Table 6.2. The result from the test shows that the characteristics of the two early and late respondents are statistically similar

because all significance values are above the alpha level of .05. Therefore, the non-response bias does not exist and it is expected that 72 respondents in this study can be representative of the whole selected sample.

Table 6.2 Non-response bias analysis

	Group	N	Mean	Std. Deviation	Significance*
Industrial group	Early	31	3.35	1.603	.298
	Late	41	3.02	1.351	
number of Employee	Early	31	2.77	.425	.705
	Late	41	2.80	.459	
Type of IS	Early	31	4.03	1.197	.272
	Late	41	3.93	1.311	

Source: Data are drawn from Question 1.6 (Industrial Group),Question 1.7 (Number of Employee) and Question 1.8 (Type of Informaiton System) :* At the .05 level of significance.

6.2.3 Profile of Respondents

Table 6.3 shows the gender, age, country of graduation, education level and work experience of respondents. The frequency and the percentage were used to analyse the data. Forty-three of 72 of respondents (59.7 %) were female and the others were male. The ages of the respondents were above 45 years old (n=35, 48.6 %) and 35-45 years old (n=31, 43.1%). Thirty-two or 44.4 % of the respondents have masters degrees and 43.1% (n= 31) of respondents have a degree while none of the respondents has a Doctoral degree. The majority of the respondent graduated in Thailand (n= 63, 87.5%). The majority of the respondents have more than 10 years work experience (61.1%), the respondents have less than 5 years work experience and 5-10 years work experience are similar at n=14, 19.4% .

Table 6.3 Characteristics of respondents

Characteristics	Categories	N	Percentage
Gender	Male	29	40.3
	Female	43	59.7
	Total	72	100.0
Age range	25- under 35 years old	6	8.3
	35-45 years old	31	43.1
	Above 45 years old	35	48.6
	Total	72	100.0
Highest education	Less than a degree	9	12.5
	Degree	31	43.1
	Master's degree	32	44.4
	Total	72	100.0
Country that graduate	Thailand	63	87.5
	USA	6	8.3
	Australia	3	4.2
	Total	72	100.0
Work experience	Less than 5 years	14	19.4
	5 - 10 years	14	19.4
	more than 10 years	44	61.1
	Total	72	100.0

Source: Data are drawn from question 1.1(Gender), Question 1.2 (Age range), Question 1.3 (Country of graduation), Question 1.4 and Question 1.5(Work experience)

The characteristics of respondents by gender and years of work experience are presented in Table 6.4. The majority of respondents is female who have more than 10 years work experience in the purchasing manager position (n=26, 36.1%). The minority of respondents is male who have less than 5 years work experience (n=5, 6.9%).

Table 6.4 Work experience and gender of respondents

Work experience		Gender		
		Male	Female	Total
Less than 5 years	Count	5	9	14
	% within Work experience	35.7%	64.3%	100.0%
	% within Gender	17.2%	20.9%	19.4%
	% of Total	6.9%	12.5%	19.4%
5 - 10 years	Count	6	8	14
	% within Work experience	42.9%	57.1%	100.0%
	% within Gender	20.7%	18.6%	19.4%
	% of Total	8.3%	11.1%	19.4%
more than 10 years	Count	18	26	44
	% within Work experience	40.9%	59.1%	100.0%
	% within Gender	62.1%	60.5%	61.1%
	% of Total	25.0%	36.1%	61.1%
Total	Count	29	43	72
	% within Work experience	40.3%	59.7%	100.0%
	% within Gender	100.0%	100.0%	100.0%
	% of Total	40.3%	59.7%	100.0%

Source: Data are drawn from Question1.1 (Gender) and Question 1.5 (Work experience)

6.2.3 Company Characteristics

In this section, the company characteristics of all respondents are described in terms of industry group and size of company. Table 6.5 shows the industry group of respondents. The majority of the respondent companies came from the industrials (n=24, 33.3%) and property and construction (n= 16, 22.2%). Participants also came from the resource and technology industrial group (n=6, 8.3%).

Table 6.5 Industry groups of respondents

Industry Group	N	Percentage
Agro and Food industry	13	18.1
Consumer Products	7	9.7
Industrials	24	33.3
Property and Construction	16	22.2
Resources	6	8.3.
Technology	6	8.3
Total	72	100.0

Source: Data are drawn from question 1.6 (Industry groups)

Although all respondents were drawn from large Thai listed companies having total fixed-asset value more than 200 million THB, in the Securities Exchange of Thailand (SET), the large Thai organisations need to be cross-checked with the number of employees of the companies. This means that the large Thai organisations have to meet both criteria. The

number of employees of all respondents is reported in Table 6.6. Only 58 companies (80.6%) participating in this study are considered to be large organisations in both number of employees and total fixed-asset value. Thirteen companies (18.1%) employed 51-200 employees or medium size and one company employed less than 50 employees which is recognised to be a small organisation.

Table 6.6 Number of employees

Number of employees	N	Percentage
Less than 50	1	1.4
51-200	13	18.1
more than 200	58	80.6
Total	72	100.0

Source: Data are drawn from question 1.7(Number of employees)

Table 6.7 shows the company characteristics data grouped by the number of employees and industrial group. The small company came from the property and construction industrial group. All participants from the agro and food industrial group and the technology industrial group employed more than 200 employees (n=13 and n =6, respectively). The resource industrial and the consumer products industrial group are considered to be medium and large size companies regarding the number of employees. Overall, the majority of participants is large-size companies by number of employee and total fixed asset value.

Table 6.7 Industrial group and number of employees

Industrial group		Number of Employee			Total
		< 50	51-200	> 200	
Agro and Food industry	Count	0	0	13	13
	% within Industrial group	.0%	.0%	100%	100%
	% within No. of Employee	.0%	.0%	22.4%	18.1%
	% of Total	.0%	.0%	18.1%	18.1%
Consumer Products	Count	0	1	7	8
	% within Industrial group	.0%	12.5%	87.5%	100%
	% within No. of Employee	.0%	7.7%	12.1%	11.1%
	% of Total	.0%	1.4%	9.7%	11.1%
Industrial Products	Count	0	4	19	23
	% within Industrial group	.0%	17.4%	82.6%	100%
	% within No. of Employee	.0%	30.8%	32.8%	31.9%
	% of Total	.0%	5.6%	26.4%	31.9%
Property and Construction	Count	1	6	9	16
	% within Industrial group	6.3%	37.5%	56.3%	100%
	% within No. of Employee	100%	46.2%	15.5%	22.2%
	% of Total	1.4%	8.3%	12.5%	22.2%
Resources	Count	0	2	4	6
	% within Industrial group	.0%	33.3%	66.7%	100%
	% within No. of Employee	.0%	15.4%	6.9%	8.3%
	% of Total	.0%	2.8%	5.6%	8.3%
Technology	Count	0	0	6	6
	% within Industrial group	.0%	.0%	100%	100%
	% within No. of Employee	.0%	.0%	10.3%	8.3%
	% of Total	.0%	.0%	8.3%	8.3%
Total	Count	1	13	58	72
	% within Industrial group	1.4%	18.1%	80.6%	100%
	% within No. of Employee	100%	100%	100%	100%
	% of Total	1.4%	18.1%	80.6%	100%

Source: Data are drawn from Question 1.6 (Industrial groups) and Question 1.7 (Number of employees)

6.2.4 Information systems in purchasing departments of Thai manufacturing companies

To understand the nature of information systems adopted in purchasing departments in large Thai manufacturing companies, all participants were ask to choose the current type of information system used in producing information to support their buying decisions. The question asks the respondent to choose only one choice from five available types of information system: manual system, in-house developed software to use only in the department, in-house developed enterprise information system, commercial software package and enterprise resource planning (ERP). Seven from 79 participants failed to answer this question. Some of them chose more than one option and some did not answer this question. These seven questionnaires were excluded from data analysis.

Table 6.8 shows the types of information system used in purchasing departments of Thai manufacturing companies. The majority of purchasing departments in large Thai manufacturing companies adopted an enterprise wide system to supply the information for buying decisions: in-house developed enterprise information system (n= 21, 29.2%) and ERP (n =38, 52.8%). A small number of purchasing departments adopted in-house developed software for department (n=2, 2.8%) and manual system (n=5, 6.9%) to produce information to support buying decisions.

Table 6.8 Type of enterprise information system in purchasing department

Type of Information system	N	Percentage
Manual system	5	6.9
In-house developed software for department only	2	2.8
In-house developed enterprise information system	21	29.2
Commercial software package	6	8.3
Enterprise Resource Planning	38	52.8
Total	72	100.0

Source: Data are drawn from question 1.8 (type of information system)

Table 6.9 presents the types of information system currently adopted by participants to produce information to support buying decisions by industrial groups. Data were presented by frequency, percentage within type of information system, percentage within industrial group and total in each dimension. The ERP system is the most adopted by Thai manufacturing companies to produce the buying decision information (n=38, 52.8%) and the least adopted software is the in-house developed departmental software (n=2, 2.8%). The industrial products group has the most commonly adopted ERP (n=9, 12.5%). All participants from the resource industrial group adopted ERP (n=6,100%). The majority of participants from the consumer products industrial group adopted ERP (n=6, 75%) while one company used commercial software and another company used in-house developed enterprise information system. A small number of the participants uses manual systems to produce information to support buying decisions (n=5, 6.9%).

Table 6.9 Types of information system and Industrial groups

Type of Information system		Industrial group						Total
		Agro and Food industry	Consumer Products	Industrial products	Property and Construct-ion	Resources	Techno-logy	
Manual system	Count	2	0	0	3	0	0	5
	% within Type of IS	40.0%	.0%	.0%	60.0%	.0%	.0%	100.0%
	% within Industrial group	15.4%	.0%	.0%	18.8%	.0%	.0%	6.9%
	% of Total	2.8%	.0%	.0%	4.2%	.0%	.0%	6.9%
In-house development for Department only	Count	0	0	1	1	0	0	2
	% within Type of IS	.0%	.0%	50.0%	50.0%	.0%	.0%	100.0%
	% within Industrial group	.0%	.0%	4.3%	6.3%	.0%	.0%	2.8%
	% of Total	.0%	.0%	1.4%	1.4%	.0%	.0%	2.8%
In-house development EIS	Count	3	1	10	5	0	2	21
	% within Type of IS	14.3%	4.8%	47.6%	23.8%	.0%	9.5%	100.0%
	% within Industrial group	23.1%	12.5%	43.5%	31.3%	.0%	33.3%	29.2%
	% of Total	4.2%	1.4%	13.9%	6.9%	.0%	2.8%	29.2%
Commercial software	Count	0	1	3	2	0	0	6
	% within Type of IS	.0%	16.7%	50.0%	33.3%	.0%	.0%	100.0%
	% within Industrial group	.0%	12.5%	13.0%	12.5%	.0%	.0%	8.3%
	% of Total	.0%	1.4%	4.2%	2.8%	.0%	.0%	8.3%
Enterprise Resource Planning	Count	8	6	9	5	6	4	38
	% within Type of IS	21.1%	15.8%	23.7%	13.2%	15.8%	10.5%	100.0%
	% within Industrial group	61.5%	75.0%	39.1%	31.3%	100.0%	66.7%	52.8%
	% of Total	11.1%	8.3%	12.5%	6.9%	8.3%	5.6%	52.8%
Total	Count	13	8	23	16	6	6	72
	% within Type of IS	18.1%	11.1%	31.9%	22.2%	8.3%	8.3%	100.0%
	% within Industrial group	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	18.1%	11.1%	31.9%	22.2%	8.3%	8.3%	100.0%

Source: Data are drawn from Question 1.6 (Industrial groups) and Question 1.8 (Type of information system)

6.3 The three aspects of information

6.3.1 The best practice

The best practice is used in many areas of management and academic study. Most of the best practices in both academic and trade associations are available in terms of guidelines but the measurement of the level of success is not available.

The Baldrige National Quality Program is one of the world quality programs that has been accepted to be excellent performance criteria for both non-profit and business organisations. Information quality represents measures of information systems output. The scoring and interpretation of Baldrige criteria are set well and adopted by many quality award programs such as the Thailand Quality Award (TQA). One category of the Baldrige National Quality Program and TQA is data and knowledge management under which the scoring and interpretation of scores are set as an effective, systematic approach, fully responsive to the

multiple requirements of the items at 90%, 95% or 100% from the total score. This study adopts the 90 percent of total score or above 6.3 score as the level of best practice.

6.3.2 The information available from the current enterprise information system

All participating purchasing managers were asked to rate their perceptions of the available level of information types from their current enterprise information system for their buying decisions and their perceptions of the information required to make good buying decisions. Twenty-three information types and 20 information qualities (see Box 6.1) were listed to be rated as available from the current enterprise information system by all participants on a seven-point scale (1 = "Not at all" and 7 = "Totally in need"). The mean scores calculated from the questionnaire were interpreted as abundant (6.50-7.00 mean score); plentiful (5.50-5.49 mean score), somewhat plentiful (4.50-6.49 mean score); average (3.50-4.49 mean score); somewhat scanty (2.50-3.49 mean score), = scanty (1.50-2.49 mean score), absent (1.00-1.49 mean score)(Young and Jamieson, 1999) as stated in section 4.4.2.

6.3.2.1 The level of information types available from enterprise information system

All participants were asked their perceptions of the level of 23 information types in buying decisions available from the current information system adopted in their department. Table 6.10 presents the number of participants (N), minimum score (Min), maximum score (Max), mean score (Mean) and standard deviation (S.D) of 23 information types of information available from current enterprise information system from the participants' point of view. The enterprise information systems are referred to as in-house developed enterprise information system and enterprise resource planning. From 72 survey respondents, only 59 cases are considered as adopting enterprise information system which included 21 cases adopting in-house development EIS and 38 cases adopting ERP systems. These 59 adopting enterprise information systems were used to report in this section onward. Most information items reported minimum available level as "Not available at all" (Min =1) except "Names and addresses of potential suppliers" and "Suppliers payment terms" were reported as minimum available level at Neutral level (Min =4) (refer to Table 6.10). The "Names and addresses of potential suppliers" is the only information available at abundant level (mean score 6.53). Many items are available at average level (mean scores lower than 5.00) such as "Purchasing survey", "Marketing analysis", "Material studies and analysis"," Environmental factor", "International trade agreement" and "Analysis of sourcing options".

Table 6.10 Level of information types available from enterprise information system

Type of information	N	Min	Max	Mean	S.D	Required Level
Names and addresses of potential suppliers	59	4	7	6.53	.817	Abundance
Reputation for on time delivery	59	1	7	5.34	1.360	Somewhat plentiful
Capacity to supply	59	1	7	5.03	1.838	Somewhat plentiful
Relationship with suppliers	59	1	7	5.95	1.151	Plentiful
Agreements and contracts with suppliers	59	1	7	5.22	1.753	Somewhat plentiful
Suppliers payment terms	58	4	7	6.38	1.006	Plentiful
Suppliers after sales service and warranty offers	59	1	7	4.88	1.830	Somewhat plentiful
Products and services specifications	59	1	7	5.46	1.442	Somewhat plentiful
Patterns of products and services demands	59	1	7	5.03	1.640	Somewhat plentiful
Quality standards	58	1	7	5.07	1.853	Somewhat plentiful
Total Cost of Ownership (TCO)	59	1	7	4.86	1.756	Somewhat plentiful
Safety stock requirements	59	1	7	5.46	1.430	Somewhat plentiful
Economic Order Quantity (EOQ)	59	1	7	4.51	2.012	Somewhat plentiful
Receiving and inspection of products and services	59	1	7	5.61	1.543	Plentiful
Purchase requisitions	59	1	7	6.15	1.142	Plentiful
Purchasing survey	58	1	7	4.40	1.825	Average
Market analysis	59	1	7	3.95	1.766	Average
Material studies and analyses	58	1	7	4.07	1.963	Average
Environmental factors	59	1	7	3.63	1.920	Average
International trade agreements	59	1	7	3.51	2.054	Average
Purchasing budget	59	1	7	5.07	1.837	Somewhat plentiful
Analysis of sourcing options	59	1	7	3.85	1.901	Average
Flow of materials	59	1	7	4.76	1.813	Somewhat plentiful

Source: Data are drawn from Question 2.2 (the types of information require for making good buying decision)

6.3.2.2 The level of information quality available from enterprise information system

The Table 6.11 presents the level of information quality available from the enterprise information system of Thai manufacturing companies. The correct quality has the highest score at 6.09 mean score while the lowest score of information quality is flexibly presented quality of information. Overall, the available levels of information quality are at somewhat plentiful to plentiful level.

Table 6.11 Level of information quality available from enterprise information system

Information quality	N	Min	Max	Mean	S.D	Requirement level
Conforming to rules	55	1	7	5.818	1.376	Plentiful
Reliable:	58	3.75	7	5.904	.867	Plentiful
-Correct	57	4	7	6.088	.969	Plentiful
-Unambiguous	58	4	7	6.000	1.060	Plentiful
- Meaningful	58	4	7	5.845	.970	Plentiful
- Non-redundant	58	3	7	5.690	1.096	Plentiful
Complete	57	3	7	5.737	1.094	Plentiful
Understandable	58	1	7	5.500	1.315	Somewhat plentiful
Accessible:	58	1	7	5.552	1.324	Plentiful
- Easy to access	58	1	7	5.621	1.387	Plentiful
- Quick to access	58	1	7	5.483	1.367	Somewhat plentiful
Secure	58	2	7	5.741	1.193	Plentiful
Suitably Presented	58	2.50	7	5.382	1.116	Somewhat plentiful
- Flexibly Presented	58	1	7	5.207	1.399	Somewhat plentiful
- Appropriate for you use of this data.	58	1	7	5.259	1.332	Somewhat plentiful
- Timely	58	2	7	5.500	1.218	Somewhat plentiful
- Suitably formatted	58	1	7	5.293	1.284	Somewhat plentiful
- Suitably precise	58	3	7	5.534	1.246	Plentiful
-Suitably measured	58	1	7	5.500	1.354	Somewhat plentiful
Valuable	58	1	7	5.362	1.541	Somewhat plentiful

Source: Data are drawn from question 3.1 Level of information quality available from enterprise information system

6.3.3 The information requirement of purchasing managers

In this section the types of information and information quality required by purchasing managers in buying decision were analysed based on the data collected from the second survey. The mean scores of required level were interpreted based on the scales provided in section 4.4.2.

6.3.3.1 The information types required by purchasing managers

All participants were asked their required level of 23 information types to make a good buying decision. Table 6.12 presents the number of participants (N), minimum score (Min), maximum score (Max), mean score (Mean) and standard deviation (S.D) of 23 information types of information required from participants' point of view.

Table 6.12 shows participants perceptions of information items required to make a good buying decision. Twenty information items were answered; all participants adopted enterprise information system (n= 59) while four items: "Patterns of products and services demands" (Mean 5.84),"Material studies and analyses" (Mean = 5.43),"Purchasing budget" (Mean = 5.79) and "Analysis of sourcing options" (Mean= 4.97) were ignore by a participant adopted enterprise information system (N=58). Overall, participants' required levels are plentiful in almost every information item except six information types: "Purchasing survey" (Mean=5.42),"Market analysis" (Mean=5.29),"Environmental actors" (Mean=4.93),"Material studies and analyses"(Mean = 5.43), "Analysis of sourcing options" (Mean= 4.97) have somewhat plentiful requirement level.

Table 6.12 Types of information require for making good buying decision

Type of information	N	Min	Max	Mean	S.D	Required Level
Names and addresses of potential suppliers	59	3	7	6.17	1.147	Plentiful
Reputation for on time delivery	59	1	7	6.39	1.114	Plentiful
Capacity to supply	59	1	7	6.49	.989	Plentiful
Relationship with suppliers	59	4	7	5.97	1.050	Plentiful
Agreements and contracts with suppliers	59	1	7	5.95	1.370	Plentiful
Suppliers payment terms	59	3	7	6.36	.943	Plentiful
Suppliers after sales service and warranty offers	59	1	7	6.17	1.191	Plentiful
Products and services specifications	59	1	7	6.29	1.145	Plentiful
Patterns of products and services demands	58	1	7	5.84	1.335	Plentiful
Quality standards	59	1	7	6.20	1.186	Plentiful
Total Cost of Ownership (TCO)	59	1	7	5.88	1.353	Plentiful
Safety stock requirements	59	1	7	5.76	1.418	Plentiful
Economic Order Quantity (EOQ)	59	1	7	5.98	1.239	Plentiful
Receiving and inspection of products and services	59	1	7	5.76	1.546	Plentiful
Purchase requisitions	59	3	7	5.81	1.293	Plentiful
Purchasing survey	59	1	7	5.42	1.417	Somewhat plentiful
Market analysis	59	1	7	5.29	1.554	Somewhat plentiful
Material studies and analyses	58	1	7	5.43	1.602	Somewhat plentiful
Environmental factors	59	1	7	4.93	1.552	Somewhat plentiful
International trade agreements	59	1	7	4.81	1.978	Somewhat plentiful
Purchasing budget	58	1	7	5.79	1.436	Plentiful
Analysis of sourcing options	58	1	7	4.97	1.696	Somewhat plentiful
Flow of materials	59	1	7	5.61	1.520	Plentiful

Source: Data are drawn from Question 2.2 the types of information require for making good buying decision.

6.3.3.2 The information quality required by purchasing managers

Table 6.13 presents the number of participants (N), minimum score (Min), maximum score (Max), mean score (Mean) and standard deviation (S.D) of the required level of information quality from the purchasing managers' perspective.

Overall, all information quality criteria were answered by participants except that "Conforming to rules" quality criteria was answered by 56 participants and Flexibly presented was answered by 58 participants. The reliability of information was rated 6.27 overall mean score calculated from the four sub-dimensions. Accessibility of information was rated 6.10 overall mean score calculated from the two sub-dimensions. Suitably presented information was rated 6.10 overall mean score calculated from the six sub-dimensions. All information quality criteria are rated at plentiful requirement level.

Table 6.13 Level of information quality required by purchasing managers

Information quality	N	Min	Max	Mean	S.D	Requirement level
Conforming to rules	56	1	7	5.96	1.321	Plentiful
Reliable:	59	1	7	6.27	1.049	Plentiful
-Correct	59	1	7	6.41	1.116	Plentiful
-Unambiguous	59	1	7	6.41	1.036	Plentiful
- Meaningful	59	1	7	6.10	1.170	Plentiful
- Non-redundant	59	1	7	6.17	1.147	Plentiful
Complete	59	1	7	6.36	1.079	Plentiful
Understandable	59	2	7	6.27	1.014	Plentiful
Accessible:	59	1	7	6.10	1.185	Plentiful
- Easy to access	59	1	7	6.07	1.230	Plentiful
- Quick to access	59	1	7	6.14	1.181	Plentiful
Secure	59	2	7	6.17	1.132	Plentiful
Suitably Presented	59	2	7	6.10	.976	Plentiful
- Flexibly Presented	58	2	7	6.05	1.191	Plentiful
- Appropriate for you use of this data.	59	2	7	6.19	1.090	Plentiful
- Timely	59	3	7	6.31	1.004	Plentiful
- Suitably formatted	59	3	7	5.93	1.143	Plentiful
- Suitably precise	59	1	7	6.03	1.217	Plentiful
-Suitably measured	59	2	7	6.12	1.052	Plentiful
Valuable	59	2	7	6.12	1.100	Plentiful

Source: Data are drawn from question 3.2 information quality required: item 1-17

6.4 The analysis between the aspects

6.4.1 Comparison between the best practice and required information

6.4.1.1 Gaps between the best practice and required information types

Exhibit 6.1 presents a scatter graph comparing the best practice level and the required level of information in buying decision of Thai manufacturing companies. Overall, the graph shows the gap between the best practice level and required level of information types in buying decisions. According to the graph, the required level of "Reputation for on time delivery", "Capacity to supply", and "Agreements and contracts with suppliers" information are above the best practice level.

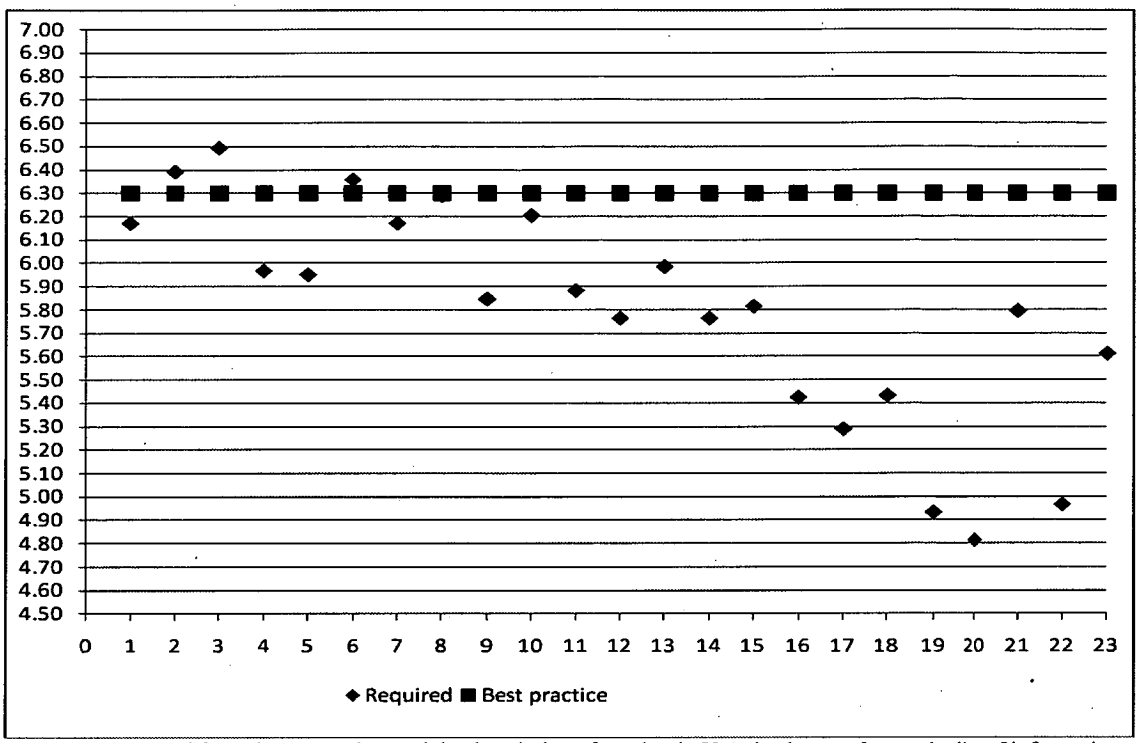
Box 6.1 List of information types and information quality (Used in Exhibit 6.1-6.8)

No.	Information types
1	Names and addresses of potential suppliers
2	Reputation for on time delivery
3	Capacity to supply
4	Relationship with suppliers
5	Agreements and contracts with suppliers
6	Suppliers payment terms
7	Suppliers after sales service and warranty offers
8	Products and services specifications
9	Patterns of products and services demands
10	Quality standards
11	Total Cost of Ownership (TCO)
12	Safety stock requirements
13	Economic Order Quantity (EOQ)
14	Receiving and inspection of products and services
15	Purchase requisitions
16	Purchasing survey
17	Market analysis
18	Material studies and analyses
19	Environmental factors
20	International trade agreements
21	Purchasing budget
22	Analysis of sourcing options
23	Flow of materials

No.	Information quality
1	Conforming to rules
2	Reliable:
3	-Correct
4	-Unambiguous
5	- Meaningful
6	- Non-redundant
7	Complete
8	Understandable
9	Accessible:
10	- Easy to access
11	- Quick to access
12	Secure
13	Suitably Presented
14	- Flexibly Presented
15	- Appropriate for you use of this data.
16	- Timely
17	- Suitably formatted
18	- Suitably precise
19	-Suitably measured
20	Valuable

Source: Generated from the questionnaire

Exhibit 6.1 The comparison between the best practice level and 23 informaiton types required by purchasing managers

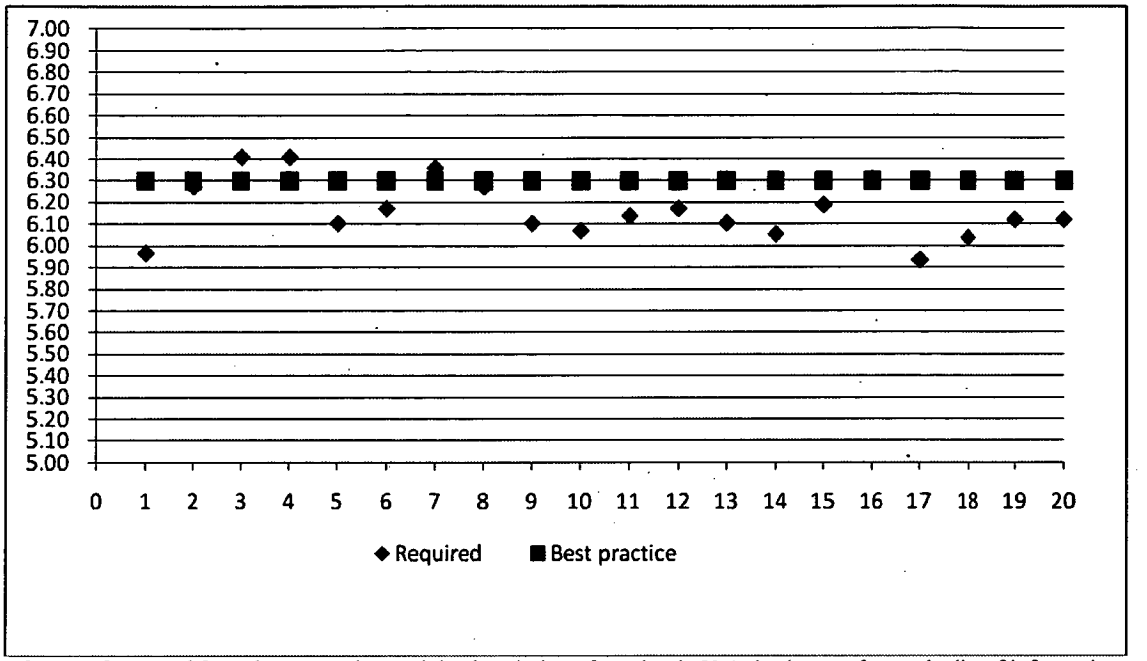


Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information types in Box 6.1

6.4.1.2 Gaps between the best practice and required information quality

Exhibit 6.2 presents a scatter graph comparing the best practice level of quality and the required level of quality of information types in buying decision of Thai manufacturing companies. According to the graph, the purchasing managers required information, "Correct", "Unambiguous", and "Complete", have quality above the best practice level.

Exhibit 6.2 The comparison between the best practice level and required level of 20 information qualities



Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information qualities in Box 6.1

6.4.2 Comparison between the best practice and available information

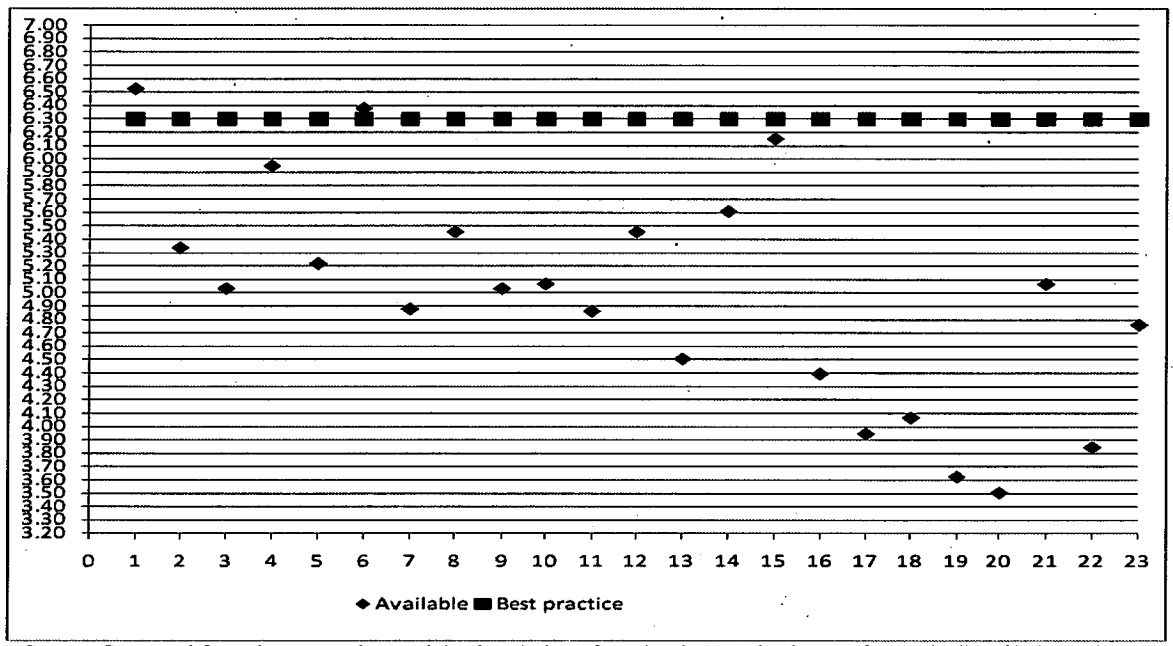
In this section the available levels of information types and information quality from the current information system were compared against the best practice level of this study. The best practice of this study set at above the 90 percent of total score (Total score =7) which mean the score above 6.3 from 7 is considered to reach the best practice level or benchmark level. The comparison of the available level and the best practice can be used to evaluate the level of ability of current information systems adopted by Thai manufacturing, that is, whether they can fulfil the requirement level of their users or they fail to meet the users' requirement. The comparisons between the best practice and the available levels are provided in graph format to show the difference between the two aspects.

6.4.2.1 Gaps between the best practice level and the information available from current EIS

Exhibit 6.3 shows a scatter graph comparing pair values of the best practice level at 6.3 score and the available level of information types from enterprise-wide information systems which, in this study, are referred to as in-house developed enterprise information system and enterprise resource planning (ERP). The X-axis presents the mean score and the Y-axis presents the number represented each type of information (Please refer to Box 6.1 for full

description of information types). The dots of each aspect of information types also show the gap between the best practice level and the available level of 23 information types from enterprise-wide information systems. Overall, every information type is available at a lower level than the best practice level. Two types of information available from current enterprise information systems are above the best practice level which are "Names and addresses of potential suppliers" and "Suppliers payment terms". The "International trade agreements" information has the biggest gap between the available level and best practice level.

Exhibit 6.3 The comparison between the best practice level and available level of 23 information types from EIS

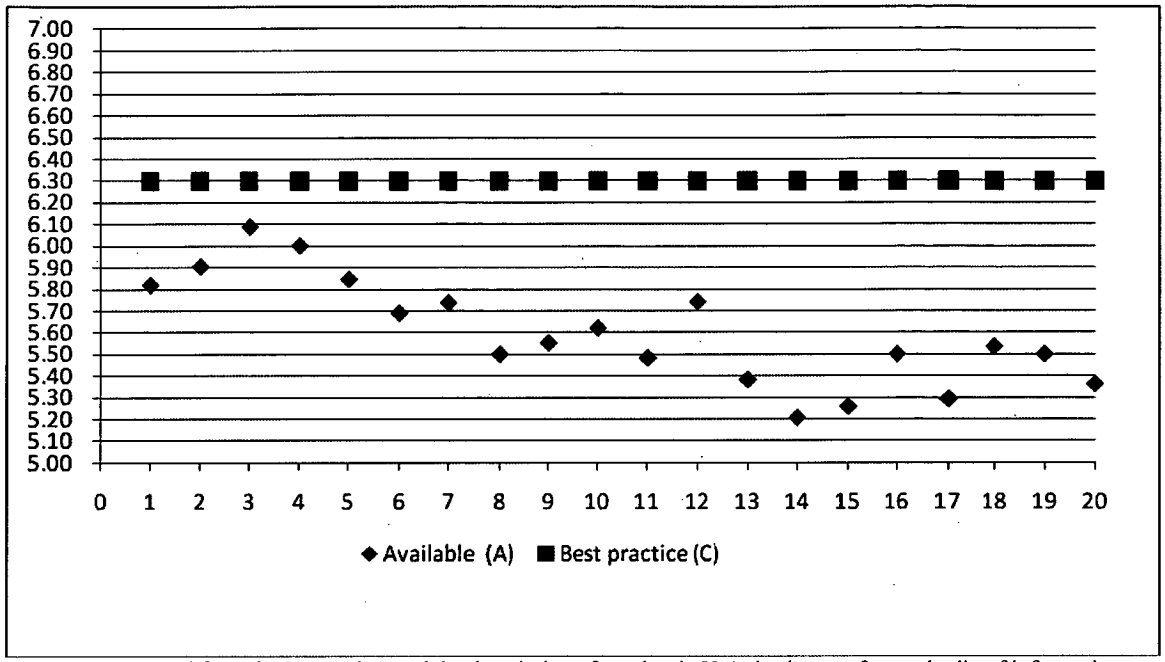


Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information types in Box 6.1

6.4.2.2 Gaps between the best practice level and the information quality available from current EIS

Exhibit 6.4 shows a scatter graph comparing pair values of the best practice level at 6.3 score and the available level of 20 information quality criteria from enterprise-wide information systems which, in this study, are referred to as in-house developed enterprise information system and enterprise resource planning (ERP). Overall, the available levels of information quality from current enterprise information systems are under the best practice level. Only correct quality is close to the best practice level. The biggest gap is between the best practice and the available level of information quality is flexibly presented.

Exhibit 6.4 The comparison between the best practice level and available level of 20 information quality from EIS



Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information qualities in Box 6.1

6.4.3 Comparison between required level and available level of information

The gap between two dependent variables can be tested by using the pair-sample t-test statistic.

6.4.3.1 Gaps between the available levels and the required levels by information types

To compare the types of information and information quality from two aspects: available from current enterprise information system aspect and required by purchasing managers' aspect, the pair sample t-test analysis is used to examine the difference between the mean score of the available level and the mean score of required level both of types of information and information quality, the pair sample t-test analysis was used to test whether there is a difference in the importance rating between two variables.

Table 6.14 shows the descriptive statistics and the pair samples t-test statistics of the available level and the required level of information types in buying decisions. The mean score column presents the difference between the available level and the required level of each information type. The mean column in the Table shows the difference between the required levels and available levels; the negative value is the result when the required level is higher than the available level. The mean score of available levels of "Names and addresses of potential suppliers" and "Purchase requisitions" are more than the mean score of required

levels. Table 6.14 also shows six pairs of types of information having p-value (Sig.) more than .05 which means that the level of available and the level of required information types are equal or not different between the two variables in "Names and addresses of potential suppliers", "Relationship with suppliers", "Suppliers payment terms", "Safety stock requirements", "Receiving and inspection of products and services", "Purchase requisitions" information. While the p-values (Sig.) of other types of information report significant p-value or there is a gap between the available level and the requirement level of those information types.

Table 6.14 Pair sample types of information available and types of information required

Pair	Mean	S.D.	t	df	Sig. (2-tailed)
Names and addresses of potential suppliers	.194	1.274	1.295	71	.200
Reputation for on time delivery	-1.125	1.414	-6.753	71	.000*
Capacity to supply	-1.389	1.858	-6.343	71	.000*
Relationship with suppliers	-.056	1.255	-.376	71	.708
Agreements and contracts with suppliers	-.681	1.767	-3.268	71	.002*
Suppliers payment terms	-.028	1.082	-.219	70	.827
Suppliers after sales service and warranty offers	-1.222	1.762	-5.886	71	.000*
Products and services specifications	-.778	1.386	-4.761	71	.000*
Patterns of products and services demands	-.803	1.644	-4.114	70	.000*
Quality standards	-1.113	1.644	-5.704	70	.000*
Total Cost of Ownership (TCO)	-.958	1.596	-5.095	71	.000*
Safety stock requirements	-.278	1.201	-1.962	71	.054
Economic Order Quantity (EOQ)	-1.375	1.857	-6.282	71	.000*
Receiving and inspection of products and services	-.181	1.476	-1.038	71	.303
Purchase requisitions	.222	1.503	1.254	71	.214
Purchasing survey	-1.014	1.652	-5.173	70	.000*
Market analysis	-1.264	1.776	-6.038	71	.000*
Material studies and analyses	-1.197	1.924	-5.242	70	.000*
Environmental factors	-1.153	1.733	-5.643	71	.000*
International trade agreements	-1.250	1.742	-6.088	71	.000*
Purchasing budget	-.831	1.690	-4.143	70	.000*
Analysis of sourcing options	-1.085	1.688	-5.413	70	.000*
Flow of materials	-.819	1.541	-4.511	71	.000*

Source: Data are drawn from question 2.1 Type of information available and question 2.2 Type of information required

* At the .05 level of significance.

6.4.3.2 Gaps between the available levels and the required levels in information quality

Table 6.15 shows the descriptive statistics and the pair samples t-test statistic between the available levels and the requirement levels of each information quality criterion. Table 6.15 shows that "Conforming to rules" information having p-value (Sig.) more than .05 which means that the level of available and the level of required of this quality is equal or not different between the means of the two populations. While the other information quality

criteria have p-values (Sig.) less than .05 or significances were found between the available level and the required level of them. The gaps between the available level and the requirement level can be found.

Table 6.15 Pair sample quality of information available and quality of information required

Pair	Mean	S.D	t	df	Sig. (2-tailed)
Conforming to rules	-.242	1.447	-1.361	65	.178
Reliable	-.408	1.254	-2.744	70	.008*
Correct	-.414	1.313	-2.640	69	.010*
Unambiguous	-.465	1.433	-2.734	70	.008*
Meaningful	-.338	1.383	-2.059	70	.043*
Non-redundant	-.549	1.472	-3.145	70	.002*
Complete	-.757	1.459	-4.342	69	.000*
Understandable	-.859	1.486	-4.871	70	.000*
Accessible	-.633	1.664	-3.208	70	0.002*
Easy to access	-.563	1.645	-2.885	70	.005*
Quick to access	-.704	1.752	-3.388	70	.001*
Secure quality	-.592	1.460	-3.415	70	.001*
Suitably Presented	-763	1.205	-5.337	70	.000*
Flexibly Presented	-.871	1.632	-4.467	69	.000*
Appropriate for you use of this data	-.972	1.639	-4.998	70	.000*
Timely	-.915	1.360	-5.672	70	.000*
Suitably formatted	-.690	1.440	-4.038	70	.000*
Suitably precise	-.592	1.214	-4.106	70	.000*
Suitably measured	-.676	1.360	-4.187	70	.000*
Valuable	-.803	1.721	-3.932	70	.000*

Source: Data are drawn from question 3.1 Information quality available and question 3.2 Information qualities required

* At the .05 level of significance.

6.5 Comparison among three aspects

As outlined in Chapter 3, the data collected by questionnaire and the best practice from the literature review are analysed with the Three-ring model: the three aspects of information are analysed to find the gaps among them. Table 6.16 presents of the three aspects of information types: the currently available from enterprise information system aspect; the perceived needed aspect; and the academic and trade associations best practice aspect. From the Table, the figures for each aspect show the existing gaps among the three aspects of information. Discrepancy 1 presents the difference between what the academic and trade associations suggested to be the best practice and that perceived to be needed by purchasing managers in Thai manufacturing companies. The gap between these two aspects presents the attitude of purchasing managers against the best practice suggested by the academic and trade associations. "Reputation for on time delivery", "Capacity to supply" and "Suppliers Payment terms" information items show that the required level is higher than the best practice

level. The gaps between the best practice and required level are large in four information items: "Market analysis", "Environmental factors", "International trade agreements", "Analysis of sourcing options"

Discrepancy 2 shows the difference between best practice suggested by academic and trade associations' information requirements and information currently available from the information systems of Thai manufacturing companies. These discrepancies use the benchmark of the current information systems and the best practice level. The results show that only two information types available from the information system are over the best practice level:"Names and addresses of potential suppliers" and "Suppliers payment terms". The gaps between the two aspects are large (the gap is over 2.0 mean score or about 30% different).

Discrepancy 3 shows the difference between the available information set and the information perceived to be needed by managers in Thai manufacturing companies. These discrepancies present the area of improvement required in current enterprise information systems. Two information types have available levels above the required levels which mean no improvement is required while for the rest of the information types, the system designers and developers should improve the available level of information types to meet the requirement of the information users.

Table 6.16 The three aspects of information types and the gaps analysis

Type of information	Available (A)	Required (B)	Best practice (C)	Discrepancy 1 (C – B)	2 (C –A)	3 (B –A)
Names and addresses of potential suppliers	6.53	6.17	6.30	0.13	-0.23	-0.36
Reputation for on time delivery	5.34	6.39	6.30	-0.09	0.96	1.05
Capacity to supply	5.03	6.49	6.30	-0.19	1.27	1.46
Relationship with suppliers	5.95	5.97	6.30	0.33	0.35	0.02
Agreements and contracts with suppliers	5.22	5.95	6.30	0.35	1.08	0.73
Suppliers payment terms	6.38	6.36	6.30	-0.06	-0.08	-0.02
Suppliers after sales service and warranty offers	4.88	6.17	6.30	0.13	1.42	1.29
Products and services specifications	5.46	6.29	6.30	0.01	0.84	0.83
Patterns of products and services demands	5.03	5.84	6.30	0.46	1.27	0.81
Quality standards	5.07	6.20	6.30	0.10	1.23	1.13
Total Cost of Ownership (TCO)	4.86	5.88	6.30	0.42	1.44	1.02
Safety stock requirements	5.46	5.76	6.30	0.54	0.84	0.31
Economic Order Quantity (EOQ)	4.51	5.98	6.30	0.32	1.79	1.47
Receiving and inspection of products and services	5.61	5.76	6.30	0.54	0.69	0.15
Purchase requisitions	6.15	5.81	6.30	0.49	0.15	-0.34
Purchasing survey	4.40	5.42	6.30	0.88	1.90	1.03
Market analysis	3.95	5.29	6.30	1.01	2.35	1.34
Material studies and analyses	4.07	5.43	6.30	0.87	2.23	1.36
Environmental factors	3.63	4.93	6.30	1.37	2.67	1.31
International trade agreements	3.51	4.81	6.30	1.49	2.79	1.31
Purchasing budget	5.07	5.79	6.30	0.51	1.23	0.73
Analysis of sourcing options	3.85	4.97	6.30	1.33	2.45	1.12
Flow of materials	4.76	5.61	6.30	0.69	1.54	0.85

Source: Data are drawn from the literature (Best practice level), Question 2.1 (Available of information types) and Question 2.2 (Required level of information types)

Table 6.17 presents the three aspects of information quality: the currently available from information system aspect; the perceived needed aspect and the academic and trade best practice aspect. From the Table, the figures of each aspect show the existing gaps among the three aspects.

From Table 6.17, Discrepancy 1 presents the difference between what the academic and trade associations think are relevant information in specific tasks and its quality and the information perceived to be needed by managers in Thai manufacturing companies which is the gap between the academic and trade organisation view and the real requirements of purchasing managers in Thai manufacturing companies. The gaps of each information quality are negative which means that in some cases the purchasing managers required a higher degree of quality than the best practice level such as "Correct", "Unambiguous", "Complete", "Understandable" and "Timely".

Discrepancy 2 shows the difference between the best practice information quality and currently available information quality from the enterprise information systems. This discrepancy could be used to benchmark the current enterprise information system against the best practice. The gaps between the best practice level and currently available from enterprise information system are quite high (difference between two mean scores more than 1.00) in "Flexibly presented", "Appropriate for use" and "suitably formatted"

Discrepancy 3 shows the difference between the available information set and the information perceived to be needed by managers in Thai manufacturing companies. This presents the area of improvement required in current enterprise information systems. The gaps between the available information set and the information perceived to be needed by managers in Thai manufacturing companies are significant in "Understandable", "Flexibly presented" and "Appropriate to use".

Table 6.17 The three aspects of information quality the gaps analysis

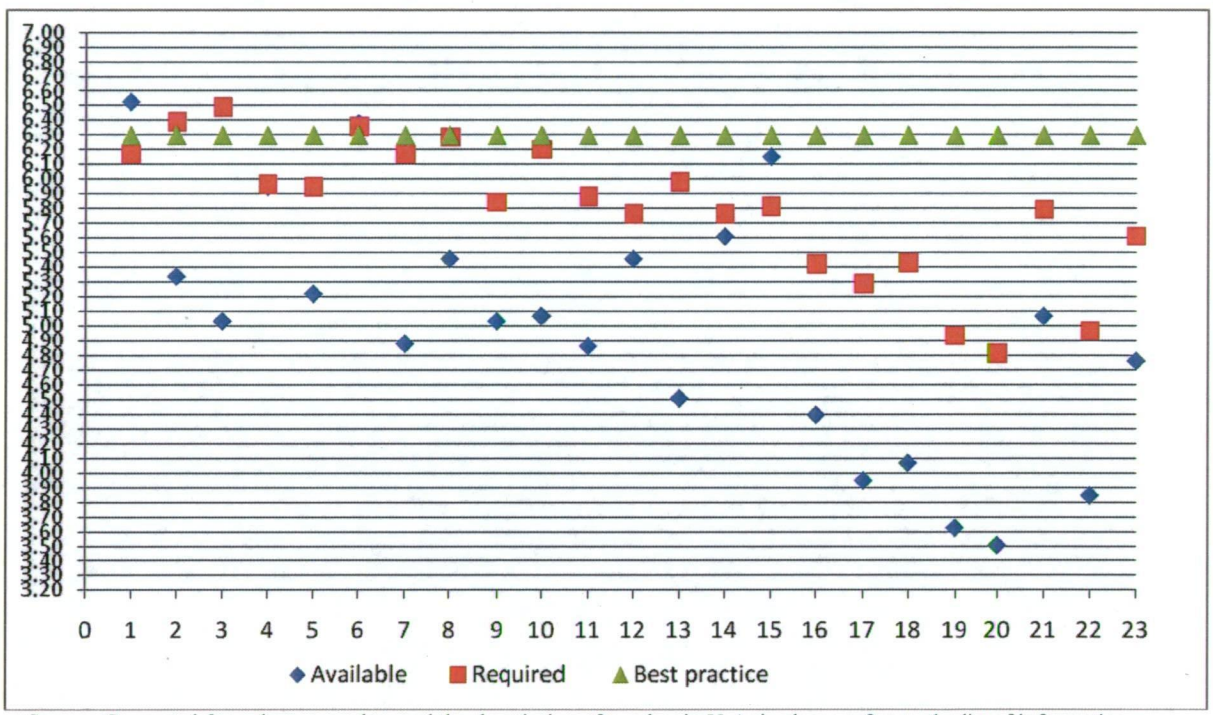
Information quality	Available (A)	Required (B)	Best practice (C)	Discrepancy		
				1 (C – B)	2 (C – A)	3 (B – A)
Conforming to rules	5.82	5.96	6.30	0.34	0.48	0.15
Reliable:	5.90	6.27	6.30	0.03	0.40	0.37
-Correct	6.09	6.41	6.30	- 0.11	0.21	0.32
-Unambiguous	6.00	6.41	6.30	- 0.11	0.30	0.41
- Meaningful	5.84	6.10	6.30	0.20	0.46	0.26
- Non-redundant	5.69	6.17	6.30	0.13	0.61	0.48
Complete	5.74	6.36	6.30	- 0.06	0.56	0.62
Understandable	5.50	6.27	6.30	0.03	0.80	0.77
Accessible:	5.55	6.10	6.30	0.20	0.75	0.55
- Easy to access	5.62	6.07	6.30	0.23	0.68	0.45
- Quick to access	5.48	6.14	6.30	0.16	0.82	0.65
Secure	5.74	6.17	6.30	0.13	0.56	0.43
Suitably Presented	5.38	6.10	6.30	0.20	0.92	0.72
- Flexibly Presented	5.21	6.05	6.30	0.25	1.09	0.84
- Appropriate for you use	5.26	6.19	6.30	0.11	1.04	0.93
- Timely	5.50	6.31	6.30	-0.01	0.80	0.81
- Suitably formatted	5.29	5.93	6.30	0.37	1.01	0.64
- Suitably precise	5.53	6.03	6.30	0.27	0.77	0.50
-Suitably measured	5.50	6.12	6.30	0.18	0.80	0.62
Valuable	5.36	6.12	6.30	0.18	0.94	0.76

Source: Data are drawn from the literature (Best practice level), Question 3.1 (Available of information quality) and Question 3.2 (Required level of information quality)

Exhibit 6.5 shows a scatter graph mapping the best practice level and the available level of information types from current enterprise information system of Thai manufacturing companies and required level of 23 information types. Overall, the required levels are close to the best practice level while the available levels of information quality are much lower than both the required level and the best practice level and the available level of information types in buying decision is under the required level and best practice level. However, the available level of some information items is above the level of best practice which are Names and

addresses of potential suppliers and Supplier payment terms. The Supplier payment term is the only information type that the required level and available level match well with the best practice level.The "Names and addresses of potential suppliers" available level and the required level are above the best practice level. The required level of "Reputation for on time delivery" and "Capacity to supply" information are above the best practice level. The "Environmental factors", "International trade agreements" and "Analysis of sourcing options" are three information types that have a large gap among the available level, required level and the best practice level.

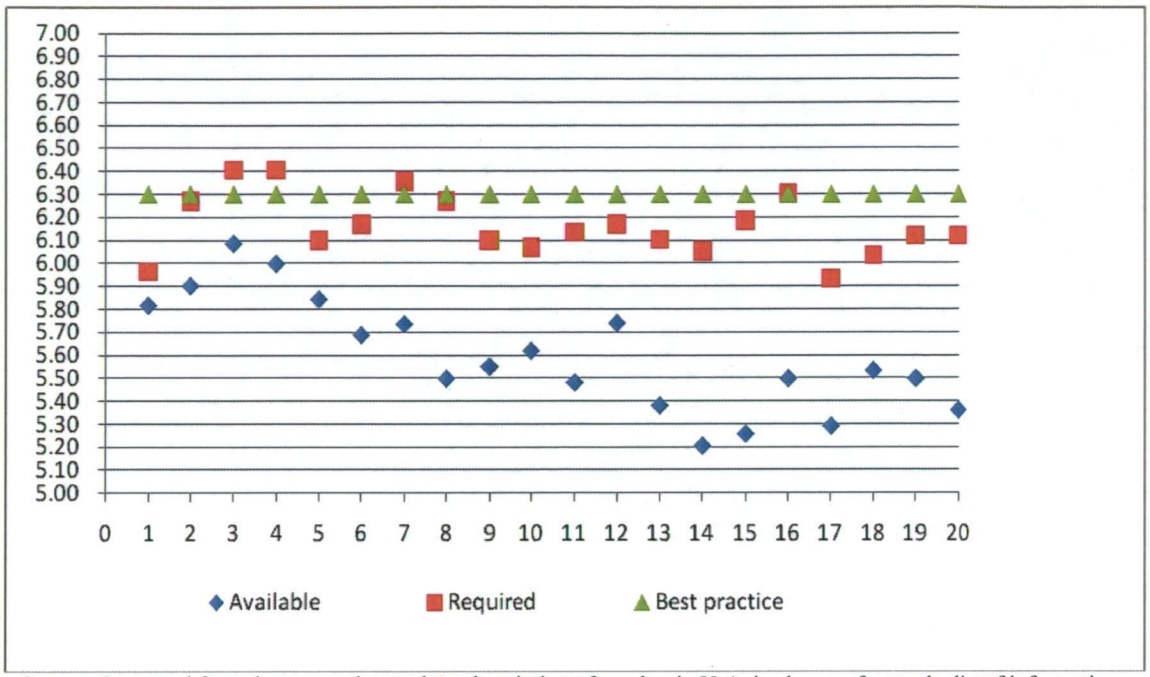
Exhibit 6.5 The comparison between three aspects of 23 information types



Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information types in Box 6.1

Exhibit 6.6 shows a scatter graph mapping the best practice level of information quality and the available level of information quality from current enterprise information system of Thai manufacturing companies and the required level of 20 information quality criteria. Overall, the available levels of 20 information quality criteria are lower than both the best practice level and the required level. Some criteria of information quality required by purchasing managers are matched quite well with the best practice level such as reliable, understandable, and timely. While correct, unambiguous, complete qualities' required level are above the best practice level.

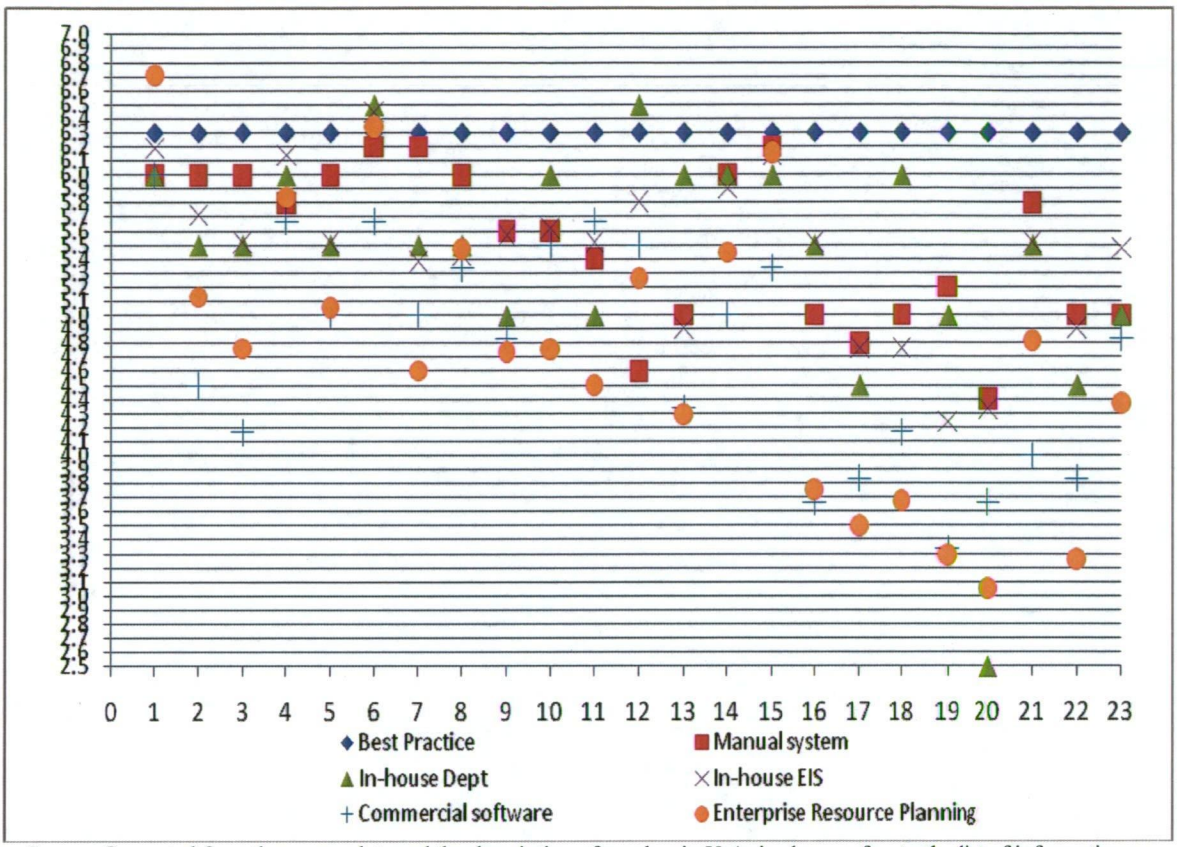
Exhibit 6.6 The comparison between the three aspects of 20 information quality



Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information qualities in Box 6.1

Exhibit 6.7 presents a scatter graph mapping multiple data points of best practice level among the available levels of information types from each type of information system in dots. The X-Axis presents the mean score of available level of 23 information types, and the Y-axis the information type details are available in Box 6.1. Overall, most of the available levels of information types are lower than the best practice level (score at 6.3) except some types of information from some information systems just reach the best practice level such as "Relationship with supplier"," Purchasing requisition". The "Names and addresses of potential suppliers" information from the enterprise resource planning systems is the only item that the available level is above the best practice level. The "International trade agreement" from the in-house developed software for purchasing departments was reported to be available at the lowest level.

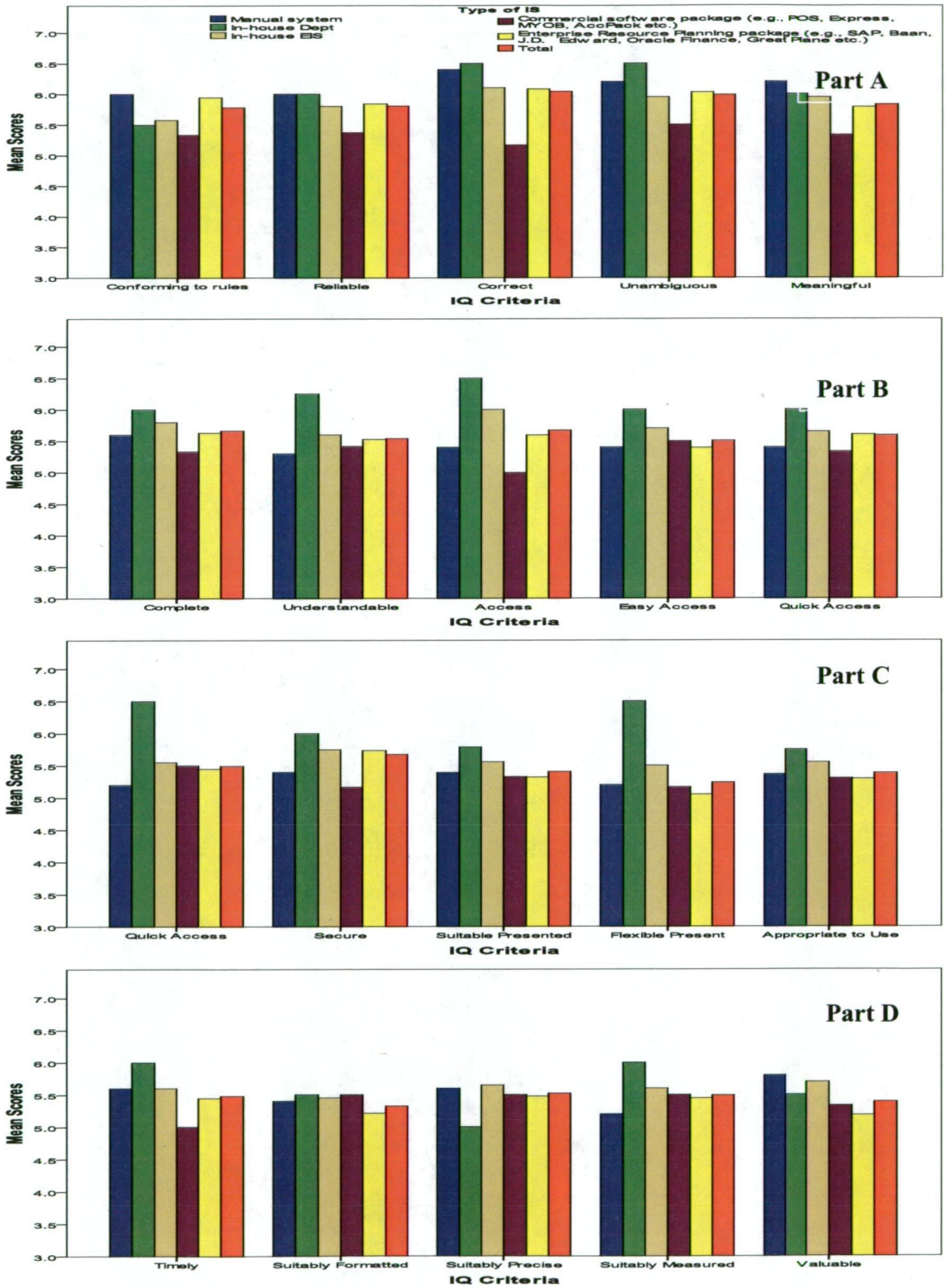
Exhibit 6.7 The comparison of available level of information types from each information system types



Source: Generated from the survey data and the description of number in Y-Axis please refers to the list of information types in Box 6.1

Exhibit 6.8 Parts A,B,C,D show the available level of information quality categorised by type of information system. Overall, the graphs show that commercial software provides the lowest level of quality compared to other types of information system except in the quick access and suitably measured and valuable quality of information. The in-house developed department softwares can provide the highest information quality in many criteria such as "Correct", "Unambiguous", "Understandable", "Accessible", "Flexible presented", "Timely" and "Suitably Measure".

Exhibit 6.8 Part: A, B, C, D: The comparison available of information quality from each information system types



Source: Generated from the survey data

6.6 Overall Information Quality

In Table 6.18, the top-3 richest information quality required and the top-3 poorest information quality required drawn from the survey participants are presented. The top-3 richest information qualities required by the participants are correct and unambiguous (both has same mean= 6.41), completeness qualities (Mean =6.36) and understandable and reliable quality (both has same mean = 6.27) of information while the top-3 poorest information quality required by the participants are suitably formatted (Mean=5.93), conform to rules (Mean =5.96) and suitably precise (6.03).

Table 6.18 The top-3 richest and poorest required information quality

Overall	Richest required IQ dimensions*	Poorest required IQ dimensions**
The 1st	Reliable –Correct and unambiguous	Suitably presented – suitably formatted
The 2nd	Completeness	Conform to rules
The 3rd	Understandable and Reliable	Suitably presented – suitably precise

Source: generated from the survey data *These IQ dimensions are evaluated as highest by the survey participants.
** These IQ dimensions are evaluated as poorest by the survey participants.

6.7 One-way ANOVA tests

The one-way ANOVA test is normally used to examine differences on a scale dependent variable between two or more groups comprising the levels of an independent variable or factor.

The ANOVA hypotheses are as follow:

H_0: $\mu_{types\ A} = \mu_{types\ B} = \mu_{types\ C} = \mu_{types\ D} = \mu_{types\ E}$

H_1: At least one of the means is different from the others

The ANOVA test is performed to test independent variables against subject factors to test the influence of a factor upon the independent variable. The LSD technique was used to test the post-hoc multiple comparisons in cases that equal variance is assumed and Dunnett's T3 technique was used in cases that equal variance is not assumed.

6.7.1 One-way ANOVA test on information system types

To check whether the information system types affect the current availability of information, the one- way ANOVA test was used.

6.7.1.1 Information types available level and information system types

This study used the one-way ANOVA in the difference on the type of information and currently available from each of the information system types. To check whether the types of information system have significant effect on the types of information available, the ANOVA technique is used. Table 6.19 presents the ANOVA test and shows that the "Purchasing

survey" and "Analysis of sourcing options" have p-value (Sig.) less than .05 which means a difference between information system types is assumed. To assess which information system types are different, further testing is conducted with LSD test and Dunnett T3 test.

Table 6.20 shows the comparison of the available levels of purchasing survey information from each type of information system by using LSD and Dunnett T3 tests. The Table shows the difference between the available levels of purchasing survey information between in-house developed EIS and that in commercial software and that in Enterprise Resource Planning.

Table 6.21 shows the comparison of the available levels of Analysis of sourcing option information from each type of information system. The LSD test shows the significant values which indicated the available level of Analysis of sourcing option information in ERP is different from that in Manual system and that in In-house developed EIS. The Dunnett T3 test reports that available level of Analysis of sourcing option information in In-house developed EIS differs from that in Enterprise Resource Planning.

Table 6.19 One-way ANOVA test for information types available and IS types

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	6.599	4	1.650	2.253	.072
Within Groups	49.054	67	.732		
Total	55.653	71			
Reputation for on time delivery					
Between Groups	11.025	4	2.756	1.669	.167
Within Groups	110.628	67	1.651		
Total	121.653	71			
Capacity to supply					
Between Groups	17.435	4	4.359	1.464	.223
Within Groups	199.440	67	2.977		
Total	216.875	71			
Relationship with suppliers					
Between Groups	1.743	4	.436	.311	.869
Within Groups	93.757	67	1.399		
Total	95.500	71			
Agreements and contracts with suppliers					
Between Groups	6.353	4	1.588	.550	.700
Within Groups	193.633	67	2.890		
Total	199.986	71			
Suppliers payment terms					
Between Groups	3.047	4	.762	.697	.597
Within Groups	72.136	66	1.093		
Total	75.183	70			
Suppliers after sales service and warranty offers					
Between Groups	16.669	4	4.167	1.415	.239
Within Groups	197.331	67	2.945		
Total	214.000	71			
Products and services specifications					
Between Groups	1.536	4	.384	.197	.939
Within Groups	130.450	67	1.947		
Total	131.986	71			
Patterns of products and services demands					
Between Groups	11.233	4	2.808	1.202	.318
Within Groups	156.545	67	2.336		
Total	167.778	71			
Quality standards					
Between Groups	13.509	4	3.377	1.112	.358
Within Groups	200.463	66	3.037		
Total	213.972	70			
Total Cost of Ownership (TCO)					
Between Groups	18.673	4	4.668	1.745	.150
Within Groups	179.271	67	2.676		
Total	197.944	71			
Safety stock requirements					
Between Groups	9.846	4	2.462	1.163	.335
Within Groups	141.807	67	2.117		
Total	151.653	71			

Table 6.19 (Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Economic Order Quantity (EOQ)					
Between Groups	10.694	4	2.674	.714	.585
Within Groups	250.959	67	3.746		
Total	261.653	71			
Receiving and inspection of products and services					
Between Groups	6.115	4	1.529	.696	.597
Within Groups	147.204	67	2.197		
Total	153.319	71			
Purchase requisitions					
Between Groups	3.743	4	.936	.669	.616
Within Groups	93.757	67	1.399		
Total	97.500	71			
Purchasing survey					
Between Groups	49.273	4	12.318	4.421	***.003****
Within Groups	183.882	66	2.786		
Total	233.155	70			
Market analysis					
Between Groups	25.543	4	6.386	2.332	.065
Within Groups	183.443	67	2.738		
Total	208.986	71			
Material studies and analyses					
Between Groups	26.488	4	6.622	1.945	.113
Within Groups	224.751	66	3.405		
Total	251.239	70			
Environmental factors					
Between Groups	27.741	4	6.935	2.194	.079
Within Groups	211.759	67	3.161		
Total	239.500	71			
International trade agreements					
Between Groups	28.183	4	7.046	1.764	.146
Within Groups	267.595	67	3.994		
Total	295.778	71			
Purchasing budget					
Between Groups	16.626	4	4.157	1.288	.284
Within Groups	216.249	67	3.228		
Total	232.875	71			
Analysis of sourcing options					
Between Groups	43.266	4	10.817	3.688	***.009****
Within Groups	196.511	67	2.933		
Total	239.778	71			
Flow of materials					
Between Groups	16.961	4	4.240	1.414	.239
Within Groups	200.914	67	2.999		
Total	217.875	71			

Source: Data are drawn from Question 1.8(Type of information systems) and Question 2.1 (Information available from current EIS), * Between groups means between each information system type.

Table 6.20 Multiple comparison of purchasing survey information available from IS types (Refer Table 6.19)

	(I) Type of IS	(J) Type of IS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Manual system	In-house Dept	-.500	1.397	.721	-3.29	2.29
		In-house EIS	-.524	.831	.530	-2.18	1.13
		Commercial software	1.333	1.011	.192	-.68	3.35
		ERP	1.243	.795	.123	-.34	2.83
	In-house Dept	Manual system	.500	1.397	.721	-2.29	3.29
		In-house EIS	-.024	1.235	.985	-2.49	2.44
		Commercial software	1.833	1.363	.183	-.89	4.55
		ERP	1.743	1.212	.155	-.68	4.16
	In-house EIS	Manual system	.524	.831	.530	-1.13	2.18
		In-house Dept	.024	1.235	.985	-2.44	2.49
		Commercial software	1.857*	.773	.019	.31	3.40
		ERP	1.767*	.456	.000	.86	2.68
	Commercial software	Manual system	-1.333	1.011	.192	-3.35	.68
		In-house Dept	-1.833	1.363	.183	-4.55	.89
		In-house EIS	-1.857*	.773	.019	-3.40	-.31
		ERP	-.090	.735	.903	-1.56	1.38
	Enterprise Resource Planning	Manual system	-1.243	.795	.123	-2.83	.34
		In-house Dept	-1.743	1.212	.155	-4.16	.68
		In-house EIS	-1.767*	.456	.000	-2.68	-.86
		Commercial software	.090	.735	.903	-1.38	1.56
Dunnett T3	Manual system	In-house Dept	-.500	1.162	1.000	-5.51	4.51
		In-house EIS	-.524	1.075	1.000	-5.44	4.39
		Commercial software	1.333	1.243	.938	-3.40	6.07
		ERP	1.243	1.093	.907	-3.60	6.09
	In-house Dept	Manual system	.500	1.162	1.000	-4.51	5.51
		In-house EIS	-.024	.553	1.000	-7.22	7.17
		Commercial software	1.833	.833	.410	-1.85	5.52
		ERP	1.743	.586	.344	-3.67	7.16
	In-house EIS	Manual system	.524	1.075	1.000	-4.39	5.44
		In-house Dept	.024	.553	1.000	-7.17	7.22
		Commercial software	1.857	.707	.234	-.93	4.64
		ERP	1.767*	.386	.000	.64	2.89
	Commercial software	Manual system	-1.333	1.243	.938	-6.07	3.40
		In-house Dept	-1.833	.833	.410	-5.52	1.85
		In-house EIS	-1.857	.707	.234	-4.64	.93
		ERP	-.090	.734	1.000	-2.85	2.67
	Enterprise Resource Planning	Manual system	-1.243	1.093	.907	-6.09	3.60
		In-house Dept	-1.743	.586	.344	-7.16	3.67
		In-house EIS	-1.767*	.386	.000	-2.89	-.64
		Commercial software	.090	.734	1.000	-2.67	2.85

Source: Data are drawn from Question 1.8(Type of information systems),*the mean difference is significant at the 0.05 level.

Table 6.21 Multiple comparison of analysis of sourcing information available of IS types (Refer to Table 6.19)

	(I) Type of IS	(J) Type of IS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Manual system	In-house Dept	.500	1.433	.728	-2.36	3.36
		In-house EIS	.095	.852	.911	-1.61	1.80
		Commercial software	1.167	1.037	.265	-.90	3.24
		ERP	***1.737****	.815	.037	.11	3.36
	In-house Dept	Manual system	-.500	1.433	.728	-3.36	2.36
		In-house EIS	-.405	1.267	.750	-2.93	2.12
		Commercial software	.667	1.398	.635	-2.12	3.46
		Enterprise Resource Planning	1.237	1.242	.323	-1.24	3.72
	In-house EIS	Manual system	-.095	.852	.911	-1.80	1.61
		In-house Dept	.405	1.267	.750	-2.12	2.93
		Commercial software	1.071	.793	.181	-.51	2.65
		ERP	***1.642****	.466	.001	.71	2.57
	Commercial software	Manual system	-1.167	1.037	.265	-3.24	.90
		In-house Dept	-.667	1.398	.635	-3.46	2.12
		In-house EIS	-1.071	.793	.181	-2.65	.51
		ERP	.570	.752	.451	-.93	2.07
	ERP	Manual system	***-1.737****	.815	.037	-3.36	-.11
		In-house Dept	-1.237	1.242	.323	-3.72	1.24
		In-house EIS	***-1.642****	.466	.001	-2.57	-.71
		Commercial software	-.570	.752	.451	-2.07	.93
Dunnett T3	Manual system	In-house Dept	.500	.671	.985	-3.63	4.63
		In-house EIS	.095	.543	1.000	-1.87	2.06
		Commercial software	1.167	.910	.860	-2.20	4.53
		ERP	1.737	.543	.089	-.22	3.69
	In-house Dept	Manual system	-.500	.671	.985	-4.63	3.63
		In-house EIS	-.405	.587	.986	-5.81	5.00
		Commercial software	.667	.937	.994	-3.23	4.56
		ERP	1.237	.587	.540	-4.14	6.61
	In-house EIS	Manual system	-.095	.543	1.000	-2.06	1.87
		In-house Dept	.405	.587	.986	-5.00	5.81
		Commercial software	1.071	.850	.866	-2.23	4.37
		ERP	1.642*	.435	.004	.37	2.91
	Commercial software	Manual system	***-1.167***	.910	.860	-4.53	2.20
		In-house Dept	-.667	.937	.994	-4.56	3.23
		In-house EIS	***-1.071***	.850	.866	-4.37	2.23
		ERP	.570	.850	.997	-2.72	3.87
	ERP	Manual system	-1.737	.543	.089	-3.69	.22
		In-house Dept	-1.237	.587	.540	-6.61	4.14
		In-house EIS	***-1.642****	.435	.004	-2.91	-.37
		Commercial software	-.570	.850	.997	-3.87	2.72

Source: Data are drawn from Question 1.8(Type of information systems) ,*the mean difference is significant at the 0.05 level.

6.6.1.2 Information quality available level and information system types

The levels of information quality available from information systems are governed by the types of enterprise information system. Table 6.22 presents insignificant p-values (Sig. value greater than .05) which means a difference of the information quality levels available between the information system types is not assumed.

Table 6.22 One-way ANOVA test for information quality available and IS types

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	3.337	4	.834	.423	.792
Within Groups	124.354	63	1.974		
Total	127.691	67			
Reliable					
Between Groups	1.422	4	.355	.357	.838
Within Groups	65.770	66	.997		
Total	67.191	70			
Correct					
Between Groups	5.781	4	1.445	1.322	.271
Within Groups	71.090	65	1.094		
Total	76.871	69			
Unambiguous					
Between Groups	2.262	4	.566	.451	.771
Within Groups	82.724	66	1.253		
Total	84.986	70			
Meaningful					
Between Groups	2.573	4	.643	.612	.656
Within Groups	69.399	66	1.052		
Total	71.972	70			
Non-redundant					
Between Groups	1.312	4	.328	.239	.915
Within Groups	90.575	66	1.372		
Total	91.887	70			
Complete					
Between Groups	6.824	4	1.706	1.280	.287
Within Groups	86.619	65	1.333		
Total	93.443	69			
Understandable					
Between Groups	1.768	4	.442	.243	.913
Within Groups	119.979	66	1.818		
Total	121.746	70			
Accessible					
Between Groups	1.466	4	.367	.194	.941
Within Groups	124.907	66	1.893		
Total	126.373	70			
Easy to access					
Between Groups	.993	4	.248	.122	.974
Within Groups	134.162	66	2.033		
Total	135.155	70			

Table 6.22 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Quick to access					
Between Groups	2.602	4	.650	.322	.862
Within Groups	133.145	66	2.017		
Total	135.746	70			
Conforming to rules					
Between Groups	2.398	4	.599	.338	.852
Within Groups	117.152	66	1.775		
Total	119.549	70			
Secure					
Between Groups	1.073	4	.268	.185	.945
Within Groups	95.634	66	1.449		
Total	96.707	70			
Suitable Presented					
Between Groups	5.902	4	1.475	.662	.620
Within Groups	147.028	66	2.228		
Total	152.930	70			
Flexibly Presented					
Between Groups	1.166	4	.292	.200	.938
Within Groups	96.256	66	1.458		
Total	97.422	70			
Appropriate for you use of this data					
Between Groups	2.324	4	.581	.357	.838
Within Groups	107.395	66	1.627		
Total	109.718	70			
Timely					
Between Groups	1.084	4	.271	.144	.965
Within Groups	124.466	66	1.886		
Total	125.549	70			
Suitably formatted					
Between Groups	.995	4	.249	.146	.964
Within Groups	112.724	66	1.708		
Total	113.718	70			
Suitably Precise					
Between Groups	1.252	4	.313	.149	.963
Within Groups	138.495	66	2.098		
Total	139.746	70			
Suitably measured					
Between Groups	4.414	4	1.103	.477	.752
Within Groups	152.544	66	2.311		
Total	156.958	70			

Source: Data are drawn from Question 3.1 (Information Quality required) and Question 1.8 (Type of information systems)

6.7.2 One-way ANOVA test on education levels

The expectation about the education level of users and the information requirement is tested by one-way ANOVA.

6.7.2.1 Information types required and the education level

To check whether education levels of purchasing managers have a significant effect on the types of information required, the ANOVA technique is used. Table 6.23 presents the

ANOVA tests of these five items are insignificant p-values (Sig.) greater than .05 which is not a difference between the education levels.

Table 6.23 One-way ANOVA test for information types required and education level of purchasing managers

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	.380	2	.190	.159	.853
Within Groups	82.606	69	1.197		
Total	82.986	71			
Reputation for on time delivery					
Between Groups	1.466	2	.733	.663	.519
Within Groups	76.312	69	1.106		
Total	77.778	71			
Capacity to supply					
Between Groups	5.524	2	2.762	2.797	.068
Within Groups	68.129	69	.987		
Total	73.653	71			
Relationship with suppliers					
Between Groups	.643	2	.321	.280	.757
Within Groups	79.302	69	1.149		
Total	79.944	71			
Agreements and contracts with suppliers					
Between Groups	3.353	2	1.676	1.011	.369
Within Groups	114.425	69	1.658		
Total	117.778	71			
Suppliers payment terms					
Between Groups	.215	2	.107	.116	.891
Within Groups	63.785	69	.924		
Total	64.000	71			
Suppliers after sales service and warranty offers					
Between Groups	3.711	2	1.856	1.476	.236
Within Groups	86.733	69	1.257		
Total	90.444	71			
Products and services specifications					
Between Groups	2.776	2	1.388	1.179	.314
Within Groups	81.210	69	1.177		
Total	83.986	71			
Patterns of products and services demands					
Between Groups	1.314	2	.657	.377	.688
Within Groups	118.658	68	1.745		
Total	119.972	70			
Quality standards					
Between Groups	2.188	2	1.094	.885	.417
Within Groups	85.312	69	1.236		
Total	87.500	71			
Total Cost of Ownership (TCO)					
Between Groups	3.373	2	1.687	.960	.388
Within Groups	121.280	69	1.758		
Total	124.653	71			

Table 6.23 (Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Safety stock requirements					
Between Groups	4.896	2	2.448	1.242	.295
Within Groups	135.979	69	1.971		
Total	140.875	71			
Economic Order Quantity (EOQ)					
Between Groups	6.516	2	3.258	2.020	.140
Within Groups	111.262	69	1.612		
Total	117.778	71			
Receiving and inspection of products and services					
Between Groups	3.003	2	1.502	.693	.503
Within Groups	149.441	69	2.166		
Total	152.444	71			
Purchase requisitions					
Between Groups	4.460	2	2.230	1.478	.235
Within Groups	104.151	69	1.509		
Total	108.611	71			
Purchasing survey					
Between Groups	8.025	2	4.013	2.077	.133
Within Groups	133.294	69	1.932		
Total	141.319	71			
Market analysis					
Between Groups	1.229	2	.615	.263	.769
Within Groups	161.215	69	2.336		
Total	162.444	71			
Material studies and analyses					
Between Groups	.284	2	.142	.057	.944
Within Groups	168.674	68	2.480		
Total	168.958	70			
Environmental factors					
Between Groups	2.685	2	1.342	.580	.563
Within Groups	159.635	69	2.314		
Total	162.319	71			
International trade agreements					
Between Groups	.550	2	.275	.075	.928
Within Groups	253.325	69	3.671		
Total	253.875	71			
Purchasing budget					
Between Groups	1.009	2	.505	.263	.769
Within Groups	130.287	68	1.916		
Total	131.296	70			
Analysis of sourcing options					
Between Groups	3.756	2	1.878	.717	.492
Within Groups	178.244	68	2.621		
Total	182.000	70			
Flow of materials					
Between Groups	.240	2	.120	.055	.947
Within Groups	150.871	69	2.187		
Total	151.111	71			

Source: Data are drawn from Question 2.2 (type of information required) and Question 1.3 (Education level)

6.7.2.2 Information quality required and the education level

The levels of information quality required from information systems are governed by the education level of purchasing managers. The ANOVA test in Table 6.24 shows insignificant values (p-value (Sig.) greater than .05) which means differences between education levels are not important.

Table 6.24 One-way ANOVA test for information quality required and education level of purchasing managers

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	.047	2	.023	.014	.986
Within Groups	110.821	65	1.705		
Total	110.868	67			
Reliable:					
Between Groups	.793	2	.397	.380	.685
Within Groups	72.050	69	1.044		
Total	72.844	71			
Correct					
Between Groups	2.250	2	1.125	.976	.382
Within Groups	79.527	69	1.153		
Total	81.778	71			
Unambiguous					
Between Groups	1.330	2	.665	.653	.524
Within Groups	70.323	69	1.019		
Total	71.653	71			
Meaningful					
Between Groups	.272	2	.136	.106	.899
Within Groups	88.339	69	1.280		
Total	88.611	71			
Non-redundant					
Between Groups	3.247	2	1.623	1.343	.268
Within Groups	83.406	69	1.209		
Total	86.653	71			
Complete					
Between Groups	2.080	2	1.040	1.036	.360
Within Groups	69.239	69	1.003		
Total	71.319	71			
Understandable					
Between Groups	1.545	2	.772	.849	.432
Within Groups	62.775	69	.910		
Total	64.319	71			
Accessible					
Between Groups	4.167	2	2.084	1.727	.185
Within Groups	83.246	69	1.206		
Total	87.413	71			
Easy to access					
Between Groups	2.921	2	1.460	1.108	.336
Within Groups	90.954	69	1.318		
Total	93.875	71			

Table 6.24 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Quick to access					
Between Groups	5.928	2	2.964	2.514	.088
Within Groups	81.350	69	1.179		
Total	87.278	71			
Secure					
Between Groups	1.490	2	.745	.638	.531
Within Groups	80.496	69	1.167		
Total	81.986	71			
Suitable Presented					
Between Groups	1.122	2	.561	.636	.532
Within Groups	60.861	69	.882		
Total	61.983	71			
Flexibly Presented					
Between Groups	.408	2	.204	.150	.861
Within Groups	92.691	68	1.363		
Total	93.099	70			
Appropriate for you use of this data					
Between Groups	1.910	2	.955	.867	.425
Within Groups	75.965	69	1.101		
Total	77.875	71			
Timely					
Between Groups	.796	2	.398	.427	.654
Within Groups	64.316	69	.932		
Total	65.111	71			
Suitably formatted					
Between Groups	1.016	2	.508	.403	.670
Within Groups	86.984	69	1.261		
Total	88.000	71			
Suitably Precise					
Between Groups	3.156	2	1.578	1.169	.317
Within Groups	93.163	69	1.350		
Total	96.319	71			
Suitably measured					
Between Groups	3.913	2	1.957	1.891	.159
Within Groups	71.406	69	1.035		
Total	75.319	71			
Valuable					
Between Groups	2.151	2	1.076	.962	.387
Within Groups	77.126	69	1.118		
Total	79.278	71			

Source: Data are drawn from Question 3.2 (Information quality required) and Question 1.3 (Education level)

6.7.3 One-way ANOVA test on country of graduation

The expectation about the country of graduation of users and the information requirement is tested by one-way ANOVA.

6.7.3.1 Information types required and the country of graduation

To check whether country of graduation of purchasing managers has significant effect on the types of information required, the ANOVA technique is used. The ANOVA test shows

insignificant p-values (Sig. greater than .05) which means a difference between countries of graduation is not important (in Table 6.25).

Table 6.25 One-way ANOVA test for information types required and country of graduation

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	1.550	2	.775	.656	.522
Within Groups	81.437	69	1.180		
Total	82.986	71			
Reputation for on time delivery					
Between Groups	1.198	2	.599	.540	.585
Within Groups	76.579	69	1.110		
Total	77.778	71			
Capacity to supply					
Between Groups	1.462	2	.731	.699	.501
Within Groups	72.190	69	1.046		
Total	73.653	71			
Relationship with suppliers					
Between Groups	.127	2	.063	.055	.947
Within Groups	79.817	69	1.157		
Total	79.944	71			
Agreements and contracts with suppliers					
Between Groups	.032	2	.016	.009	.991
Within Groups	117.746	69	1.706		
Total	117.778	71			
Suppliers payment terms					
Between Groups	1.516	2	.758	.837	.437
Within Groups	62.484	69	.906		
Total	64.000	71			
Suppliers after sales service and warranty offers					
Between Groups	2.127	2	1.063	.831	.440
Within Groups	88.317	69	1.280		
Total	90.444	71			
Products and services specifications					
Between Groups	2.938	2	1.469	1.251	.293
Within Groups	81.048	69	1.175		
Total	83.986	71			
Patterns of products and services demands					
Between Groups	2.757	2	1.378	.800	.454
Within Groups	117.215	68	1.724		
Total	119.972	70			
Quality standards					
Between Groups	1.016	2	.508	.405	.668
Within Groups	86.484	69	1.253		
Total	87.500	71			
Total Cost of Ownership (TCO)					
Between Groups	4.240	2	2.120	1.215	.303
Within Groups	120.413	69	1.745		
Total	124.653	71			

Table 6.25 (Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Safety stock requirements					
Between Groups	.518	2	.259	.127	.881
Within Groups	140.357	69	2.034		
Total	140.875	71			
Economic Order Quantity (EOQ)					
Between Groups	2.627	2	1.313	.787	.459
Within Groups	115.151	69	1.669		
Total	117.778	71			
Receiving and inspection of products and services					
Between Groups	3.556	2	1.778	.824	.443
Within Groups	148.889	69	2.158		
Total	152.444	71			
Purchase requisitions					
Between Groups	1.016	2	.508	.326	.723
Within Groups	107.595	69	1.559		
Total	108.611	71			
Purchasing survey					
Between Groups	1.724	2	.862	.426	.655
Within Groups	139.595	69	2.023		
Total	141.319	71			
Market analysis					
Between Groups	2.032	2	1.016	.437	.648
Within Groups	160.413	69	2.325		
Total	162.444	71			
Material studies and analyses					
Between Groups	2.355	2	1.177	.481	.621
Within Groups	166.603	68	2.450		
Total	168.958	70			
Environmental factors					
Between Groups	3.073	2	1.537	.666	.517
Within Groups	159.246	69	2.308		
Total	162.319	71			
International trade agreements					
Between Groups	8.446	2	4.223	1.187	.311
Within Groups	245.429	69	3.557		
Total	253.875	71			
Purchasing budget					
Between Groups	3.925	2	1.962	1.048	.356
Within Groups	127.371	68	1.873		
Total	131.296	70			
Analysis of sourcing options					
Between Groups	3.530	2	1.765	.673	.356
Within Groups	178.470	68	2.625		
Total	182.000	70			
Flow of materials					
Between Groups	6.127	2	3.063	1.458	.240
Within Groups	144.984	69	2.101		
Total	151.111	71			

Source: Data are drawn from Question 2.2 (type of information required) and Question 1.2 (Graduated country)

6.7.3.2 Information quality required and the country of graduation

The levels of information quality required from information systems are governed by the country of graduation of purchasing managers. The ANOVA technique is used. The ANOVA test in Table 6.26 shows insignificant p-values (Sig. greater than .05) which means a difference between the countries of graduation is not important.

Table 6.26 One-way ANOVA test for information quality required and country of graduated

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	3.602	2	1.801	1.091	.342
Within Groups	107.266	65	1.650		
Total	110.868	67			
Reliable:					
Between Groups	.719	2	.359	.344	.710
Within Groups	72.125	69	1.045		
Total	72.844	71			
Correct					
Between Groups	.889	2	.444	.379	.686
Within Groups	80.889	69	1.172		
Total	81.778	71			
Unambiguous					
Between Groups	.383	2	.191	.185	.831
Within Groups	71.270	69	1.033		
Total	71.653	71			
Meaningful					
Between Groups	2.008	2	1.004	.800	.453
Within Groups	86.603	69	1.255		
Total	88.611	71			
Non-redundant					
Between Groups	.240	2	.120	.096	.909
Within Groups	86.413	69	1.252		
Total	86.653	71			
Complete					
Between Groups	.558	2	.279	.272	.763
Within Groups	70.762	69	1.026		
Total	71.319	71			
Understandable					
Between Groups	.669	2	.334	.362	.697
Within Groups	63.651	69	.922		
Total	64.319	71			
Accessible					
Between Groups	.929	2	.465	.371	.692
Within Groups	86.484	69	1.253		
Total	87.413	71			
Easy to access					
Between Groups	.986	2	.493	.366	.695
Within Groups	92.889	69	1.346		
Total	93.875	71			

Table 6.26 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Quick to access					
Between Groups	.897	2	.448	.358	.700
Within Groups	86.381	69	1.252		
Total	87.278	71			
Secure					
Between Groups	.240	2	.120	.101	.904
Within Groups	81.746	69	1.185		
Total	81.986	71			
Suitable Presented					
Between Groups	.721	2	.361	.406	.668
Within Groups	61.262	69	.888		
Total	61.983	71			
Flexibly Presented					
Between Groups	2.244	2	1.122	.840	.436
Within Groups	90.855	68	1.336		
Total	93.099	70			
Appropriate for you use of this data					
Between Groups	.661	2	.330	.295	.745
Within Groups	77.214	69	1.119		
Total	77.875	71			
Timely					
Between Groups	1.675	2	.837	.911	.407
Within Groups	63.437	69	.919		
Total	65.111	71			
Suitably formatted					
Between Groups	1.897	2	.948	.760	.472
Within Groups	86.103	69	1.248		
Total	88.000	71			
Suitably Precise					
Between Groups	.597	2	.299	.215	.807
Within Groups	95.722	69	1.387		
Total	96.319	71			
Suitably measured					
Between Groups	.272	2	.136	.125	.883
Within Groups	75.048	69	1.088		
Total	75.319	71			
Valuable					
Between Groups	.698	2	.349	.307	.737
Within Groups	78.579	69	1.139		
Total	79.278	71			

Source: Data are drawn from Question 3.2 (Information quality required) and Question 1.2 (Graduated country)

6.7.4 One-way ANOVA test on work experience

The expectation about the relationship between the work experience and the information requirement is tested by one-way ANOVA.

6.6.4.1 Information types required and work experience

To check whether work experience of purchasing managers has a significant effect on the types of information required, the ANOVA technique is used. The ANOVA report in Table

6.27 shows insignificant p-values (Sig. greater than .05) which means a difference between the work experiences is not important.

Table 6.27 One-way ANOVA test for information types required and work experience

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	.970	2	.485	.408	.667
Within Groups	82.016	69	1.189		
Total	82.986	71			
Reputation for on time delivery					
Between Groups	.054	2	.027	.024	.976
Within Groups	77.724	69	1.126		
Total	77.778	71			
Capacity to supply					
Between Groups	1.104	2	.552	.525	.594
Within Groups	72.549	69	1.051		
Total	73.653	71			
Relationship with suppliers					
Between Groups	.035	2	.018	.015	.985
Within Groups	79.909	69	1.158		
Total	79.944	71			
Agreements and contracts with suppliers					
Between Groups	2.427	2	1.214	.726	.488
Within Groups	115.351	69	1.672		
Total	117.778	71			
Suppliers payment terms					
Between Groups	2.899	2	1.450	1.637	.202
Within Groups	61.101	69	.886		
Total	64.000	71			
Suppliers after sales service and warranty offers					
Between Groups	.574	2	.287	.220	.803
Within Groups	89.870	69	1.302		
Total	90.444	71			
Products and services specifications					
Between Groups	.330	2	.165	.136	.873
Within Groups	83.656	69	1.212		
Total	83.986	71			
Patterns of products and services demands					
Between Groups	1.734	2	.867	.499	.610
Within Groups	118.238	68	1.739		
Total	119.972	70			
Quality standards					
Between Groups	.555	2	.278	.220	.803
Within Groups	86.945	69	1.260		
Total	87.500	71			
Total Cost of Ownership (TCO)					
Between Groups	.101	2	.050	.028	.972
Within Groups	124.552	69	1.805		
Total	124.653	71			
Safety stock requirements					
Between Groups	2.482	2	1.241	.619	.542
Within Groups	138.393	69	2.006		
Total	140.875	71			

Table 6.27 (Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Economic Order Quantity (EOQ)					
Between Groups	6.297	2	3.149	1.949	.150
Within Groups	111.481	69	1.616		
Total	117.778	71			
Receiving and inspection of products and services					
Between Groups	1.185	2	.592	.270	.764
Within Groups	151.260	69	2.192		
Total	152.444	71			
Purchase requisitions					
Between Groups	1.381	2	.690	.444	.643
Within Groups	107.231	69	1.554		
Total	108.611	71			
Purchasing survey					
Between Groups	10.095	2	5.048	2.654	.078
Within Groups	131.224	69	1.902		
Total	141.319	71			
Market analysis					
Between Groups	10.720	2	5.360	2.438	.095
Within Groups	151.724	69	2.199		
Total	162.444	71			
Material studies and analyses					
Between Groups	9.964	2	4.982	2.131	.127
Within Groups	158.993	68	2.338		
Total	168.958	70			
Environmental factors					
Between Groups	10.446	2	5.223	2.373	.101
Within Groups	151.873	69	2.201		
Total	162.319	71			
International trade agreements					
Between Groups	7.219	2	3.610	1.010	.370
Within Groups	246.656	69	3.575		
Total	253.875	71			
Purchasing budget					
Between Groups	1.681	2	.841	.441	.645
Within Groups	129.615	68	1.906		
Total	131.296	70			
Analysis of sourcing options					
Between Groups	5.514	2	2.757	1.062	.351
Within Groups	176.486	68	2.595		
Total	182.000	70			
Flow of materials					
Between Groups	.920	2	.460	.211	.810
Within Groups	150.192	69	2.177		
Total	151.111	71			

Source: Data are drawn from Question 1.5(Work experience) and Question 2.2 (Information required from current EIS), * Between groups means between each information system type.

6.7.4.2 Information quality required and work experience

The levels of information quality required from information systems are governed by work experience of the purchasing managers. The ANOVA technique is used. Table 6.28 shows

that the ANOVA tests report insignificant values (Sig. greater than .05) which means a difference between years of work experiences is not important.

Table 6.28 One-way ANOVA test for information quality required and work experience

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	1.511	2	.755	.449	.640
Within Groups	109.357	65	1.682		
Total	110.868	67			
Reliable					
Between Groups	1.542	2	.771	.746	.478
Within Groups	71.302	69	1.033		
Total	72.844	71			
Correct					
Between Groups	2.833	2	1.416	1.238	.296
Within Groups	78.945	69	1.144		
Total	81.778	71			
Unambiguous					
Between Groups	3.140	2	1.570	1.581	.213
Within Groups	68.513	69	.993		
Total	71.653	71			
Meaningful					
Between Groups	2.183	2	1.091	.871	.423
Within Groups	86.429	69	1.253		
Total	88.611	71			
Non-redundant					
Between Groups	2.387	2	1.193	.977	.382
Within Groups	84.266	69	1.221		
Total	86.653	71			
Complete					
Between Groups	1.875	2	.937	.931	.399
Within Groups	69.445	69	1.006		
Total	71.319	71			
Understandable					
Between Groups	1.641	2	.820	.903	.410
Within Groups	62.679	69	.908		
Total	64.319	71			
Accessible					
Between Groups	3.312	2	1.656	1.359	.264
Within Groups	84.101	69	1.219		
Total	87.413	71			
Easy to access					
Between Groups	3.323	2	1.662	1.266	.288
Within Groups	90.552	69	1.312		
Total	93.875	71			
Quick to access					
Between Groups	3.372	2	1.686	1.386	.257
Within Groups	83.906	69	1.216		
Total	87.278	71			
Secure					
Between Groups	1.084	2	.542	.462	.632
Within Groups	80.903	69	1.173		
Total	81.986	71			

Table 6.28 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Suitable Presented					
Between Groups	1.411	2	.706	.804	.452
Within Groups	60.572	69	.878		
Total	61.983	71			
Flexibly Presented					
Between Groups	2.050	2	1.025	.766	.469
Within Groups	91.048	68	1.339		
Total	93.099	70			
Appropriate for you use of this data					
Between Groups	1.586	2	.793	.717	.492
Within Groups	76.289	69	1.106		
Total	77.875	71			
Timely					
Between Groups	2.098	2	1.049	1.149	.323
Within Groups	63.013	69	.913		
Total	65.111	71			
Suitably formatted					
Between Groups	2.899	2	1.450	1.175	.315
Within Groups	85.101	69	1.233		
Total	88.000	71			
Suitably Precise					
Between Groups	.625	2	.312	.225	.799
Within Groups	95.695	69	1.387		
Total	96.319	71			
Suitably measured					
Between Groups	1.459	2	.730	.682	.509
Within Groups	73.860	69	1.070		
Total	75.319	71			
Valuable					
Between Groups	3.658	2	1.829	1.669	.196
Within Groups	75.620	69	1.096		
Total	79.278	71			

Source: Data are drawn from Question 3.1 (Information Quality required) and Question 1.8 (Work experience)

6.7.5 One-way ANOVA test on industrial groups

To check whether the industrial group affects the requirement of information, the one- way ANOVA test was used.

6.7.5.1 Information types required level and industrial groups

The ANOVA test reports significant p-value (Sig.) in three items of information (Table 6.29): Economic Order Quantity (EOQ); Purchasing Survey and Marketing Analysis but the ANOVA test alone cannot specify which industrial group is different from the other. The LSD test and Dunnett T3 were used to find out.

Table 6.30 shows the multiple comparison of economic order quantity (EOQ) information required in each industrial group. The LSD test shows that the difference in the required level

of EOQ information; in the property and construction industrial group is different from that in the Agro and food industry, that in the consumer products industrial group and that in the industrial products industrial group; and the difference in the required level of EOQ information between the Agro and food industry group and that of the resource industrial group.

Table 6.31 shows the multiple comparison of purchasing survey information required in each industrial group. The LSD test shows that the difference in the required level of purchasing survey information in the resource industrial group is different from that in the Agro and food industry group, the consumer products industrial group and the industrial products industrial group. The required level of purchasing survey in the property and construction industrial also differs from that in the Agro and food industry, the consumer products industrial group, and the industrial products industrial group. The test also reports the difference in the required level of purchasing survey information in the technology industrial group among that in the resource industrial group and that in the property and construction industrial group. The Dunnett T3 tests from Table 6.33 show that the required level of purchasing survey information in the resource industrial group is different from the Argo and food industry group, the industrial products industrial group and the technology industrial group while the required level of purchasing survey in the technology industrial group differs from the property and construction industrial group.

Table 6.32 shows the multiple comparison of marketing analysis information required level in each industrial group. The LSD test shows the required level of marketing analysis information in the consumer products industrial group differs from that in the property and construction industrial group and that in the resource industrial group. The marketing analysis information is also required at different levels in the resource industrial group and in the industrial products industrial group, the Argo and food industry group and the technology industrial group.

Table 6.29 One-way ANOVA test for information type required and industrial groups

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	9.806	5	1.961	1.769	.131
Within Groups	73.180	66	1.109		
Total	82.986	71			
Reputation for on time delivery					
Between Groups	7.632	5	1.526	1.436	.223
Within Groups	70.146	66	1.063		
Total	77.778	71			
Capacity to supply					
Between Groups	3.127	5	.625	.585	.711
Within Groups	70.526	66	1.069		
Total	73.653	71			
Relationship with suppliers					
Between Groups	5.014	5	1.003	.883	.497
Within Groups	74.931	66	1.135		
Total	79.944	71			
Agreements and contracts with suppliers					
Between Groups	3.849	5	.770	.446	.815
Within Groups	113.929	66	1.726		
Total	117.778	71			
Suppliers payment terms					
Between Groups	6.292	5	1.258	1.439	.222
Within Groups	57.708	66	.874		
Total	64.000	71			
Suppliers after sales service and warranty offers					
Between Groups	4.996	5	.999	.772	.573
Within Groups	85.448	66	1.295		
Total	90.444	71			
Products and services specifications					
Between Groups	4.029	5	.806	.665	.651
Within Groups	79.957	66	1.211		
Total	83.986	71			
Patterns of products and services demands					
Between Groups	8.966	5	1.793	1.050	.396
Within Groups	111.006	65	1.708		
Total	119.972	70			
Quality standards					
Between Groups	5.372	5	1.074	.863	.510
Within Groups	82.128	66	1.244		
Total	87.500	71			
Total Cost of Ownership (TCO)					
Between Groups	14.240	5	2.848	1.702	.146
Within Groups	110.412	66	1.673		
Total	124.653	71			
Safety stock requirements					
Between Groups	19.440	5	3.888	2.113	.075
Within Groups	121.435	66	1.840		
Total	140.875	71			

Table 6.29 (Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Economic Order Quantity (EOQ)					
Between Groups	18.684	5	3.737	2.489	***.040****
Within Groups	99.094	66	1.501		
Total	117.778	71			
Receiving and inspection of products and services					
Between Groups	17.217	5	3.443	1.681	.152
Within Groups	135.227	66	2.049		
Total	152.444	71			
Purchase requisitions					
Between Groups	5.889	5	1.178	.757	.584
Within Groups	102.722	66	1.556		
Total	108.611	71			
Purchasing survey					
Between Groups	27.496	5	5.499	3.189	***.012****
Within Groups	113.824	66	1.725		
Total	141.319	71			
Market analysis					
Between Groups	28.038	5	5.608	2.754	***.026****
Within Groups	134.406	66	2.036		
Total	162.444	71			
Material studies and analyses					
Between Groups	25.668	5	5.134	2.329	.052
Within Groups	143.290	65	2.204		
Total	168.958	70			
Environmental factors					
Between Groups	9.227	5	1.845	.796	.557
Within Groups	153.093	66	2.320		
Total	162.319	71			
International trade agreements					
Between Groups	35.691	5	7.138	2.159	.069
Within Groups	218.184	66	3.306		
Total	253.875	71			
Purchasing budget					
Between Groups	4.380	5	.876	.449	.813
Within Groups	126.916	65	1.953		
Total	131.296	70			
Analysis of sourcing options					
Between Groups	19.649	5	3.930	1.573	.180
Within Groups	162.351	65	2.498		
Total	182.000	70			
Flow of materials					
Between Groups	14.817	5	2.963	1.435	.223
Within Groups	136.294	66	2.065		
Total	151.111	71			

Source: Data are drawn from Question 2.2 (Information required) and Question 1.6 (Industrials group)

Table 6.30 Multiple comparison of Economic Order Quantity (EOQ) information required from each industrial groups

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Agro and Food industry	Consumer Products	.135	.551	.808	-.96	1.23
		Industrials	.167	.425	.695	-.68	1.02
		Property and Construction	***1.197****	.458	.011	.28	2.11
		Resources	***1.218****	.605	.048	.01	2.43
		Technology	.051	.605	.933	-1.16	1.26
	Consumer Products	Agro and Food industry	-.135	.551	.808	-1.23	.96
		Industrials	.033	.503	.949	-.97	1.04
		Property and Construction	***1.063****	.531	.049	.00	2.12
		Resources	1.083	.662	.106	-.24	2.40
		Technology	-.083	.662	.900	-1.40	1.24
	Industrials	Agro and Food industry	-.167	.425	.695	-1.02	.68
		Consumer Products	-.033	.503	.949	-1.04	.97
		Property and Construction	***1.030****	.399	.012	.23	1.83
		Resources	1.051	.562	.066	-.07	2.17
		Technology	-.116	.562	.837	-1.24	1.01
	Property and Construction	Agro and Food industry	***-1.197****	.458	.011	-2.11	-.28
		Consumer Products	***-1.063****	.531	.049	-2.12	.00
		Industrials	***-1.030****	.399	.012	-1.83	-.23
		Resources	.021	.587	.972	-1.15	1.19
		Technology	-1.146	.587	.055	-2.32	.03
	Resources	Agro and Food industry	***-1.218****	.605	.048	-2.43	-.01
		Consumer Products	-1.083	.662	.106	-2.40	.24
		Industrials	-1.051	.562	.066	-2.17	.07
		Property and Construction	-.021	.587	.972	-1.19	1.15
		Technology	-1.167	.707	.104	-2.58	.25
	Technology	Agro and Food industry	-.051	.605	.933	-1.26	1.16
		Consumer Products	.083	.662	.900	-1.24	1.40
		Industrials	.116	.562	.837	-1.01	1.24
		Property and Construction	1.146	.587	.055	-.03	2.32
		Resources	1.167	.707	.104	-.25	2.58

The mean difference is significant at the 0.05 level.

Table 6.30 (Continued)

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dunnett T3		Consumer Products	.135	.365	1.000	-1.08	1.35
		Industrials	.167	.344	1.000	-.93	1.26
	Agro and Food industry	Property and Construction	1.197	.514	.317	-.46	2.85
		Resources	1.218	.547	.435	-.89	3.33
		Technology	.051	.562	1.000	-2.13	2.23
		Agro and Food industry	-.135	.365	1.000	-1.35	1.08
		Industrials	.033	.331	1.000	-1.07	1.13
	Consumer Products	Property and Construction	1.063	.506	.462	-.59	2.71
		Resources	1.083	.539	.554	-1.04	3.20
		Technology	-.083	.554	1.000	-2.28	2.11
		Agro and Food industry	-.167	.344	1.000	-1.26	.93
		Consumer Products	-.033	.331	1.000	-1.13	1.07
	Industrials	Property and Construction	1.030	.491	.461	-.56	2.62
		Resources	1.051	.524	.561	-1.05	3.15
		Technology	-.116	.540	1.000	-2.30	2.07
		Agro and Food industry	-1.197	.514	.317	-2.85	.46
		Consumer Products	-1.063	.506	.462	-2.71	.59
	Property and Construction	Industrials	-1.030	.491	.461	-2.62	.56
		Resources	.021	.649	1.000	-2.22	2.26
		Technology	-1.146	.662	.717	-3.45	1.15
		Agro and Food industry	-1.218	.547	.435	-3.33	.89
		Consumer Products	-1.083	.539	.554	-3.20	1.04
	Resources	Industrials	-1.051	.524	.561	-3.15	1.05
		Property and Construction	-.021	.649	1.000	-2.26	2.22
		Technology	-1.167	.687	.736	-3.69	1.36
		Agro and Food industry	-.051	.562	1.000	-2.23	2.13
		Consumer Products	.083	.554	1.000	-2.11	2.28
	Technology	Industrials	.116	.540	1.000	-2.07	2.30
		Property and Construction	1.146	.662	.717	-1.15	3.45
		Resources	1.167	.687	.736	-1.36	3.69

Source: Data are drawn from Question 2.2 (Information required) and Question 1.6 (Industrials group) and refer to Table 6.29. *. The mean difference is significant at the 0.05 level.

Table 6.31 Multiple comparison of purchasing survey information required from each industrial groups: (Refer to Table 6.29)

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Agro and Food industry	Consumer Products	-.029	.590	.961	-1.21	1.15
		Industrials	.281	.456	.540	-.63	1.19
		Property and Construction	***1.159****	.490	.021	.18	2.14
		Resources	***1.679****	.648	.012	.39	2.97
		Technology	-.487	.648	.455	-1.78	.81
	Consumer Products	Agro and Food industry	.029	.590	.961	-1.15	1.21
		Industrials	.310	.539	.567	-.77	1.39
		Property and Construction	***1.188****	.569	.041	.05	2.32
		Resources	***1.708****	.709	.019	.29	3.12
		Technology	-.458	.709	.520	-1.87	.96
	Industrials	Agro and Food industry	-.281	.456	.540	-1.19	.63
		Consumer Products	-.310	.539	.567	-1.39	.77
		Property and Construction	***.878****	.428	.044	.02	1.73
		Resources	***1.399****	.602	.023	.20	2.60
		Technology	-.768	.602	.206	-1.97	.43
	Property and Construction	Agro and Food industry	***-1.159****	.490	.021	-2.14	-.18
		Consumer Products	***-1.188****	.569	.041	-2.32	-.05
		Industrials	***-.878****	.428	.044	-1.73	-.02
		Resources	.521	.629	.410	-.73	1.78
		Technology	***-1.646****	.629	.011	-2.90	-.39
	Resources	Agro and Food industry	***-1.679****	.648	.012	-2.97	-.39
		Consumer Products	***-1.708****	.709	.019	-3.12	-.29
		Industrials	***-1.399****	.602	.023	-2.60	-.20
		Property and Construction	-.521	.629	.410	-1.78	.73
		Technology	***-2.167****	.758	.006	-3.68	-.65
	Technology	Agro and Food industry	.487	.648	.455	-.81	1.78
		Consumer Products	.458	.709	.520	-.96	1.87
		Industrials	.768	.602	.206	-.43	1.97
		Property and Construction	***1.646****	.629	.011	.39	2.90
		Resources	***2.167****	.758	.006	.65	3.68

*. The mean difference is significant at the 0.05 level.

Table 6.31(Continued)

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dunnett T3	Agro and Food industry	Consumer Products	-.029	.586	1.000	-2.06	2.00
		Industrials	.281	.433	1.000	-1.10	1.66
		Property and Construction	1.159	.543	.431	-.57	2.89
		Resources	***1.679****	.376	.005	.41	2.95
		Technology	-.487	.397	.959	-1.82	.84
	Consumer Products	Agro and Food industry	.029	.586	1.000	-2.00	2.06
		Industrials	.310	.552	1.000	-1.65	2.27
		Property and Construction	1.188	.641	.637	-.95	3.33
		Resources	1.708	.508	.094	-.23	3.64
		Technology	-.458	.524	.996	-2.41	1.49
	Industrials	Agro and Food industry	-.281	.433	1.000	-1.66	1.10
		Consumer Products	-.310	.552	1.000	-2.27	1.65
		Property and Construction	.878	.505	.718	-.73	2.49
		Resources	1.399*	.320	.003	.38	2.42
		Technology	-.768	.345	.379	-1.89	.35
	Property and Construction	Agro and Food industry	-1.159	.543	.431	-2.89	.57
		Consumer Products	-1.188	.641	.637	-3.33	.95
		Industrials	-.878	.505	.718	-2.49	.73
		Resources	.521	.457	.977	-.99	2.03
		Technology	***-1.646****	.475	.034	-3.21	-.08
	Resources	Agro and Food industry	***-1.679****	.376	.005	-2.95	-.41
		Consumer Products	-1.708	.508	.094	-3.64	.23
		Industrials	***-1.399****	.320	.003	-2.42	-.38
		Property and Construction	-.521	.457	.977	-2.03	.99
		Technology	***-2.167****	.269	.000	-3.17	-1.17
	Technology	Agro and Food industry	.487	.397	.959	-.84	1.82
		Consumer Products	.458	.524	.996	-1.49	2.41
		Industrials	.768	.345	.379	-.35	1.89
		Property and Construction	***1.646****	.475	.034	.08	3.21
		Resources	***2.167****	.269	.000	1.17	3.17

Source: Data are drawn from Question 2.2 (Information required) and Question 1.6 (Industrials group) and refer to Table 6.29. *. The mean difference is significant at the 0.05 level.

Table 6.32 Multiple comparison of marketing analysis information required from each industrial groups

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Agro and Food industry	Consumer Products	-.587	.641	.364	-1.87	.69
		Industrials	.191	.495	.701	-.80	1.18
		Property and Construction	.663	.533	.217	-.40	1.73
		Resources	***1.872****	.704	.010	.47	3.28
		Technology	-.462	.704	.515	-1.87	.94
	Consumer Products	Agro and Food industry	.587	.641	.364	-.69	1.87
		Industrials	.777	.586	.189	-.39	1.95
		Property and Construction	***1.250****	.618	.047	.02	2.48
		Resources	***2.458****	.771	.002	.92	4.00
		Technology	.125	.771	.872	-1.41	1.66
	Industrials	Agro and Food industry	-.191	.495	.701	-1.18	.80
		Consumer Products	-.777	.586	.189	-1.95	.39
		Property and Construction	.473	.465	.312	-.45	1.40
		Resources	***1.681****	.654	.012	.38	2.99
		Technology	-.652	.654	.322	-1.96	.65
	Property and Construction	Agro and Food industry	-.663	.533	.217	-1.73	.40
		Consumer Products	***-1.250****	.618	.047	-2.48	-.02
		Industrials	-.473	.465	.312	-1.40	.45
		Resources	1.208	.683	.082	-.16	2.57
		Technology	-1.125	.683	.104	-2.49	.24
	Resources	Agro and Food industry	***-1.872****	.704	.010	-3.28	-.47
		Consumer Products	***-2.458****	.771	.002	-4.00	-.92
		Industrials	***-1.681****	.654	.012	-2.99	-.38
		Property and Construction	-1.208	.683	.082	-2.57	.16
		Technology	***-2.333****	.824	.006	-3.98	-.69
	Technology	Agro and Food industry	.462	.704	.515	-.94	1.87
		Consumer Products	-.125	.771	.872	-1.66	1.41
		Industrials	.652	.654	.322	-.65	1.96
		Property and Construction	1.125	.683	.104	-.24	2.49
		Resources	***2.333****	.824	.006	.69	3.98

*. The mean difference is significant at the 0.05 level.

Table 6.32 (Continued)

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dunnett T3	Agro and Food industry	Consumer Products	-.587	.605	.993	-2.65	1.48
		Industrials	.191	.475	1.000	-1.32	1.71
		Property and Construction	.663	.534	.961	-1.04	2.37
		Resources	1.872	.762	.331	-1.07	4.81
		Technology	-.462	.580	.999	-2.52	1.60
	Consumer Products	Agro and Food industry	.587	.605	.993	-1.48	2.65
		Industrials	.777	.565	.907	-1.20	2.75
		Property and Construction	1.250	.616	.517	-.83	3.33
		Resources	2.458	.821	.147	-.58	5.50
		Technology	.125	.656	1.000	-2.20	2.45
	Industrials	Agro and Food industry	-.191	.475	1.000	-1.71	1.32
		Consumer Products	-.777	.565	.907	-2.75	1.20
		Property and Construction	.473	.488	.996	-1.07	2.01
		Resources	1.681	.731	.411	-1.26	4.62
		Technology	-.652	.538	.953	-2.63	1.33
	Property and Construction	Agro and Food industry	-.663	.534	.961	-2.37	1.04
		Consumer Products	-1.250	.616	.517	-3.33	.83
		Industrials	-.473	.488	.996	-2.01	1.07
		Resources	1.208	.770	.806	-1.73	4.15
		Technology	-1.125	.591	.605	-3.19	.94
	Resources	Agro and Food industry	-1.872	.762	.331	-4.81	1.07
		Consumer Products	-2.458	.821	.147	-5.50	.58
		Industrials	-1.681	.731	.411	-4.62	1.26
		Property and Construction	-1.208	.770	.806	-4.15	1.73
		Technology	-2.333	.803	.177	-5.38	.72
	Technology	Agro and Food industry	.462	.580	.999	-1.60	2.52
		Consumer Products	-.125	.656	1.000	-2.45	2.20
		Industrials	.652	.538	.953	-1.33	2.63
		Property and Construction	1.125	.591	.605	-.94	3.19
		Resources	2.333	.803	.177	-.72	5.38

Source: Data are drawn from Question 2.2 (Informationrequired) and Question 1.6 (Industrials group) and refer to Table 6.29. *. The mean difference is significant at the 0.05 level.

6.7.5.2 Information quality required and industrial groups

The levels of information quality required from information systems are governed by industrial groups. The ANOVA technique is used. Table 6.33 shows that "Appropriate for your use of this data" has a p-value (sig.) less than .05. This means the Appropriate for your use of this data quality of information is governed by the work experience of purchasing manager. However, the ANOVA table cannot specify and indicate the group that differs from others. To find out which work experience of purchasing managers is different from the others, the LSD and Dunnett T3 test specified earlier were used. Table 6.34 presents the

multiple comparison appropriate levels for use of quality of information and industry groups. The LSD test shows that the required level of appropriate for use quality of information is different between Resource industrial and four other industrial groups: Agro and Food industry, Consumer Product industry, Industrial products industry, and Technology industry while the Dunnett T3 did not find any significant result among the groups.

Table 6.33 One-way ANOVA test for information quality required and industrial groups

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	15.827	5	3.165	2.065	.082
Within Groups	95.041	62	1.533		
Total	110.868	67			
Reliable					
Between Groups	8.586	5	1.717	1.764	.133
Within Groups	64.257	66	.974		
Total	72.844	71			
Correct					
Between Groups	11.136	5	2.227	2.081	.079
Within Groups	70.641	66	1.070		
Total	81.778	71			
Unambiguous					
Between Groups	10.305	5	2.061	2.217	.063
Within Groups	61.348	66	.930		
Total	71.653	71			
Meaningful					
Between Groups	7.462	5	1.492	1.214	.312
Within Groups	81.149	66	1.230		
Total	88.611	71			
Non-redundant					
Between Groups	8.790	5	1.758	1.490	.205
Within Groups	77.863	66	1.180		
Total	86.653	71			
Complete					
Between Groups	9.332	5	1.866	1.987	.092
Within Groups	61.987	66	.939		
Total	71.319	71			
Understandable					
Between Groups	8.390	5	1.678	1.980	.093
Within Groups	55.929	66	.847		
Total	64.319	71			
Accessible					
Between Groups	10.308	5	2.062	1.765	.132
Within Groups	77.105	66	1.168		
Total	87.413	71			
Easy to access					
Between Groups	10.311	5	2.062	1.629	.165
Within Groups	83.564	66	1.266		
Total	93.875	71			

Table 6.33 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Quick to access					
Between Groups	10.473	5	2.095	1.800	.125
Within Groups	76.804	66	1.164		
Total	87.278	71			
Secure					
Between Groups	6.791	5	1.358	1.192	.323
Within Groups	75.195	66	1.139		
Total	81.986	71			
Suitable Presented					
Between Groups	6.973	5	1.395	1.673	.153
Within Groups	55.010	66	.833		
Total	61.983	71			
Flexibly Presented					
Between Groups	5.830	5	1.166	.868	.507
Within Groups	87.269	65	1.343		
Total	93.099	70			
Appropriate for you use of this data					
Between Groups	12.176	5	2.435	2.446	.043*
Within Groups	65.699	66	.995		
Total	77.875	71			
Timely					
Between Groups	4.999	5	1.000	1.098	.370
Within Groups	60.113	66	.911		
Total	65.111	71			
Suitably formatted					
Between Groups	6.147	5	1.229	.991	.430
Within Groups	81.853	66	1.240		
Total	88.000	71			
Suitably Precise					
Between Groups	12.233	5	2.447	1.920	.103
Within Groups	84.086	66	1.274		
Total	96.319	71			
Suitably measured					
Between Groups	11.160	5	2.232	2.296	.055
Within Groups	64.159	66	.972		
Total	75.319	71			
Valuable					
Between Groups	5.284	5	1.057	.943	.459
Within Groups	73.993	66	1.121		
Total	79.278	71			

Source: Data are drawn from Question 3.1 (Information Quality required) and Question 1.6 (Industrials group)

Table 6.34 Multiple comparison of appropriate for use quality and industrial groups

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Agro and Food industry	Consumer Products	.192	.448	.669	-.70	1.09
		Industrials	.605	.346	.085	-.09	1.30
		Property and Construction	.630	.373	.096	-.11	1.37
		Resources	***1.526****	.492	.003	.54	2.51
		Technology	.026	.492	.959	-.96	1.01
	Consumer Products	Agro and Food industry	-.192	.448	.669	-1.09	.70
		Industrials	.413	.410	.317	-.40	1.23
		Property and Construction	.438	.432	.315	-.43	1.30
		Resources	***1.333****	.539	.016	.26	2.41
		Technology	-.167	.539	.758	-1.24	.91
	Industrials	Agro and Food industry	-.605	.346	.085	-1.30	.09
		Consumer Products	-.413	.410	.317	-1.23	.40
		Property and Construction	.024	.325	.940	-.62	.67
		Resources	***.920****	.457	.048	.01	1.83
		Technology	-.580	.457	.209	-1.49	.33
	Property and Construction	Agro and Food industry	-.630	.373	.096	-1.37	.11
		Consumer Products	-.438	.432	.315	-1.30	.43
		Industrials	-.024	.325	.940	-.67	.62
		Resources	.896	.478	.065	-.06	1.85
		Technology	-.604	.478	.210	-1.56	.35
	Resources	Agro and Food industry	***-1.526****	.492	.003	-2.51	-.54
		Consumer Products	***-1.333****	.539	.016	-2.41	-.26
		Industrials	***-.920****	.457	.048	-1.83	.00
		Property and Construction	-.896	.478	.065	-1.85	.06
		Technology	***-1.500****	.576	.011	-2.65	-.35
	Technology	Agro and Food industry	-.026	.492	.959	-1.01	.96
		Consumer Products	.167	.539	.758	-.91	1.24
		Industrials	.580	.457	.209	-.33	1.49
		Property and Construction	.604	.478	.210	-.35	1.56
		Resources	***1.500****	.576	.011	.35	2.65

*. The mean difference is significant at the 0.05 level.

Table 6.34 (Continued)

	(I) Industrial group	(J) Industrial group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dunnett T3	Agro and Food industry	Consumer Products	.192	.299	1.000	-.89	1.28
		Industrials	.605	.270	.354	-.24	1.45
		Property and Construction	.630	.252	.230	-.18	1.44
		Resources	1.526	.803	.627	-2.09	5.14
		Technology	.026	.249	1.000	-.91	.96
	Consumer Products	Agro and Food industry	-.192	.299	1.000	-1.28	.89
		Industrials	.413	.356	.974	-.77	1.59
		Property and Construction	.438	.342	.944	-.72	1.59
		Resources	1.333	.836	.785	-2.21	4.88
		Technology	-.167	.340	1.000	-1.37	1.04
	Industrials	Agro and Food industry	-.605	.270	.354	-1.45	.24
		Consumer Products	-.413	.356	.974	-1.59	.77
		Property and Construction	.024	.317	1.000	-.96	1.01
		Resources	.920	.826	.964	-2.63	4.47
		Technology	-.580	.315	.646	-1.62	.46
	Property and Construction	Agro and Food industry	-.630	.252	.230	-1.44	.18
		Consumer Products	-.438	.342	.944	-1.59	.72
		Industrials	-.024	.317	1.000	-1.01	.96
		Resources	.896	.821	.967	-2.67	4.46
		Technology	-.604	.300	.530	-1.63	.42
	Resources	Agro and Food industry	-1.526	.803	.627	-5.14	2.09
		Consumer Products	-1.333	.836	.785	-4.88	2.21
		Industrials	-.920	.826	.964	-4.47	2.63
		Property and Construction	-.896	.821	.967	-4.46	2.67
		Technology	-1.500	.820	.662	-5.07	2.07
	Technology	Agro and Food industry	-.026	.249	1.000	-.96	.91
		Consumer Products	.167	.340	1.000	-1.04	1.37
		Industrials	.580	.315	.646	-.46	1.62
		Property and Construction	.604	.300	.530	-.42	1.63
		Resources	1.500	.820	.662	-2.07	5.07

Source: Data are drawn from Question 3.1 (Information Quality required) and Question 1.6 (Industrials group) and refer to Table 6.33. *. The mean difference is significant at the 0.05 level.

6.7.6 One-way ANOVA test on age of managers

To check whether the age of managers affects the requirement of information, the one- way ANOVA test was used.

6.7.6.1 Information types required level and age group of managers

The ANOVA test reports significant p-values (Sig.) in two items of information (Table 6.35). Table 6.36 show the multiple comparison of purchasing requisition information required in each age group of managers. The LSD test shows the different required levels of purchasing requisition information by managers aged between 35 and 45 is different from that in the

above 45 years old group. Table 6.37 shows the multiple comparison of international trade agreement information required in each age group of managers: the LSD test shows that the required level of international trade agreement information for managers aged between 35 and 45 years old is different from that in the above 45 years old group.

Table 6.35 One-way ANOVA test for information type required and age group of manager

Information types	Sum of Squares	df	Mean Square	F	Sig.
Names and addresses of potential suppliers					
Between Groups	2.659	2	1.329	1.024	.366
Within Groups	67.523	52	1.299		
Total	70.182	54			
Reputation for on time delivery					
Between Groups	.357	2	.178	.135	.874
Within Groups	68.625	52	1.320		
Total	68.982	54			
Capacity to supply					
Between Groups	1.022	2	.511	.486	.618
Within Groups	54.723	52	1.052		
Total	55.745	54			
Relationship with suppliers					
Between Groups	1.926	2	.963	.893	.416
Within Groups	56.074	52	1.078		
Total	58.000	54			
Agreements and contracts with suppliers					
Between Groups	4.039	2	2.019	1.024	.366
Within Groups	102.507	52	1.971		
Total	106.545	54			
Suppliers payment terms					
Between Groups	1.367	2	.683	.724	.490
Within Groups	49.070	52	.944		
Total	50.436	54			
Suppliers after sales service and warranty offers					
Between Groups	.907	2	.453	.311	.734
Within Groups	75.893	52	1.459		
Total	76.800	54			
Products and services specifications					
Between Groups	.063	2	.032	.022	.978
Within Groups	74.373	52	1.430		
Total	74.436	54			
Patterns of products and services demands					
Between Groups	3.678	2	1.839	1.026	.365
Within Groups	93.159	52	1.792		
Total	96.836	54			
Quality standards					
Between Groups	.726	2	.363	.242	.786
Within Groups	78.074	52	1.501		
Total	78.800	54			
Total Cost of Ownership (TCO)					
Between Groups	.785	2	.393	.199	.820
Within Groups	102.560	52	1.972		
Total	103.345	54			

Table 6.35(Continued)

Information types	Sum of Squares	df	Mean Square	F	Sig.
Safety stock requirements					
Between Groups	5.261	2	2.630	1.359	.266
Within Groups	100.667	52	1.936		
Total	105.927	54			
Economic Order Quantity (EOQ)					
Between Groups	2.345	2	1.172	.721	.491
Within Groups	84.492	52	1.625		
Total	86.836	54			
Receiving and inspection of products and services					
Between Groups	.354	2	.177	.081	.922
Within Groups	113.173	52	2.176		
Total	113.527	54			
Purchase requisitions					
Between Groups	10.002	2	5.001	3.509	.037
Within Groups	74.107	52	1.425		
Total	84.109	54			
Purchasing survey					
Between Groups	2.062	2	1.031	.489	.616
Within Groups	109.647	52	2.109		
Total	111.709	54			
Market analysis					
Between Groups	4.142	2	2.071	.816	.448
Within Groups	131.967	52	2.538		
Total	136.109	54			
Material studies and analyses					
Between Groups	3.821	2	1.910	.701	.501
Within Groups	141.707	52	2.725		
Total	145.527	54			
Environmental factors					
Between Groups	5.042	2	2.521	.988	.379
Within Groups	132.667	52	2.551		
Total	137.709	54			
International trade agreements					
Between Groups	24.214	2	12.107	3.349	.043
Within Groups	187.967	52	3.615		
Total	212.182	54			
Purchasing budget					
Between Groups	3.954	2	1.977	.935	.399
Within Groups	109.973	52	2.115		
Total	113.927	54			
Analysis of sourcing options					
Between Groups	6.388	2	3.194	1.081	.347
Within Groups	153.612	52	2.954		
Total	160.000	54			
Flow of materials					
Between Groups	.409	2	.205	.086	.917
Within Groups	123.336	52	2.372		
Total	123.745	54			

Source: Data are drawn from Question 2.2 (Information type required) and Question 1.2 (Age group).

Table 6.36 Multiple comparison of purchase requisition information required from each age group of manager

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	25- under 35 years old	35-45 years old	-.556	.727	.448	-2.01	.90
		Above 45 years old	-1.320	.729	.076	-2.78	.14
	35-45 years old	25- under 35 years old	.556	.727	.448	-.90	2.01
		Above 45 years old	***-.764***	.331	.025	-1.43	-.10
	Above 45 years old	25- under 35 years old	1.320	.729	.076	-.14	2.78
		35-45 years old	.764*	.331	.025	.10	1.43
Dunnett T3	25- under 35 years old	35-45 years old	-.556	1.182	.946	-7.35	6.24
		Above 45 years old	-1.320	1.170	.659	-8.33	5.69
	35-45 years old	25- under 35 years old	.556	1.182	.946	-6.24	7.35
		Above 45 years old	-.764	.315	.056	-1.54	.01
	Above 45 years old	25- under 35 years old	1.320	1.170	.659	-5.69	8.33
		35-45 years old	.764	.315	.056	-.01	1.54

*. The mean difference is significant at the 0.05 level.

Table 6.37 Multiple comparison of international trade agreement information required from each age group of manager

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	25- under 35 years old	35-45 years old	-1.815	1.157	.123	-4.14	.51
		Above 45 years old	-.573	1.162	.624	-2.90	1.76
	35-45 years old	25- under 35 years old	1.815	1.157	.123	-.51	4.14
		Above 45 years old	***1.241***	.528	.022	.18	2.30
	Above 45 years old	25- under 35 years old	.573	1.162	.624	-1.76	2.90
		35-45 years old	***-1.241***	.528	.022	-2.30	-.18
Dunnett T3	25- under 35 years old	35-45 years old	-1.815	1.484	.615	-10.41	6.78
		Above 45 years old	-.573	1.515	.970	-8.69	7.54
	35-45 years old	25- under 35 years old	1.815	1.484	.615	-6.78	10.41
		Above 45 years old	1.241	.526	.066	-.06	2.54
	Above 45 years old	25- under 35 years old	.573	1.515	.970	-7.54	8.69
		35-45 years old	-1.241	.526	.066	-2.54	.06

Source: Data are drawn from Question 2.2 (Information type required) and Question 1.2 (Age group) and refer to Table 6.35. *. The mean difference is significant at the 0.05 level.

6.7.6.2 Information quality required and age group of managers

The levels of information quality required from information systems are governed by age of managers. The ANOVA technique is used. Table 6.38 presents insignificant p-values (Sig. value greater than .05) which means a difference in the level information quality available level between the manager ages is not important.

Table 6.38 One-way ANOVA test for information quality required and age of managers

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Conforming to rules					
Between Groups	2.143	2	1.072	.601	.552
Within Groups	92.693	52	1.783		
Total	94.836	54			
Reliable					
Between Groups	1.504	2	.752	.646	.528
Within Groups	60.548	52	1.164		
Total	62.052	54			
Correct					
Between Groups	2.075	2	1.038	.783	.462
Within Groups	68.907	52	1.325		
Total	70.982	54			
Unambiguous					
Between Groups	.463	2	.232	.199	.820
Within Groups	60.519	52	1.164		
Total	60.982	54			
Meaningful					
Between Groups	1.847	2	.923	.640	.531
Within Groups	74.990	52	1.442		
Total	76.836	54			
Non-redundant					
Between Groups	2.216	2	1.108	.801	.454
Within Groups	71.893	52	1.383		
Total	74.109	54			
Complete					
Between Groups	3.079	2	1.539	1.277	.287
Within Groups	62.667	52	1.205		
Total	65.745	54			
Understandable					
Between Groups	.268	2	.134	.122	.886
Within Groups	57.114	52	1.098		
Total	57.382	54			
Accessible					
Between Groups	.471	2	.236	.157	.855
Within Groups	78.074	52	1.501		
Total	78.545	54			
Easy to access					
Between Groups	.376	2	.188	.117	.890
Within Groups	83.333	52	1.603		
Total	83.709	54			
Quick to access					
Between Groups	.605	2	.302	.205	.815
Within Groups	76.741	52	1.476		
Total	77.345	54			
Secure					
Between Groups	2.202	2	1.101	.811	.450
Within Groups	70.634	52	1.358		
Total	72.836	54			

Table 6.38 (Continued)

Information quality	Sum of Squares	df	Mean Square	F	Sig.
Suitable Presented					
Between Groups	1.372	2	.686	.686	.508
Within Groups	52.010	52	1.000		
Total	53.382	54			
Flexibly Presented					
Between Groups	.463	2	.232	.153	.858
Within Groups	78.519	52	1.510		
Total	78.982	54			
Appropriate for you use of this data					
Between Groups	1.767	2	.883	.706	.498
Within Groups	65.070	52	1.251		
Total	66.836	54			
Timely					
Between Groups	5.920	2	2.960	3.114	.053
Within Groups	49.425	52	.950		
Total	55.345	54			
Suitably formatted					
Between Groups	1.210	2	.605	.465	.631
Within Groups	67.627	52	1.301		
Total	68.836	54			
Suitably Precise					
Between Groups	1.493	2	.747	.482	.620
Within Groups	80.507	52	1.548		
Total	82.000	54			
Suitably measured					
Between Groups	.572	2	.286	.240	.787
Within Groups	61.973	52	1.192		
Total	62.545	54			
Valuable					
Between Groups	1.342	2	.671	.529	.592
Within Groups	66.003	52	1.269		
Total	67.345	54			

Source: Data are drawn from Question 3.1 (Information Quality required) and Question 1.2 (Age group)

6.7.7 Independent-sample T-test on gender of managers

6.7.7.1 Independent-sample T-test on information type required and gender of managers

The independent-sample T-test was used to compare means for the gender of managers and information types. Table 6.39 presents the independent-sample T-test of information type required by each gender. Many items of information have significance values less than .05. While the variance between groups of male managers and groups of female managers are not equal which are; "Names and addresses of potential suppliers" , "Reputation for on time delivery", "Suppliers payment terms", "Suppliers after sales service and warranty offers", "Patterns of products and services demands" and "Economic Order Quantity (EOQ)".

Table 6.39 Independent-sample T-test on information types required and gender of managers

Information types	Equal variances	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Names and addresses of potential suppliers	assumed	76.16	.000	-3.563	57	.001	-.988	.277	-1.543	-.433
	not assumed			-3.112	28.434	.004	-.988	.318	-1.638	-.338
Reputation for on time delivery	assumed	8.931	.004	-2.306	57	.025	-.657	.285	-1.228	-.087
	not assumed			-2.058	31.011	.048	-.657	.319	-1.308	-.006
Capacity to supply	assumed	6.664	.012	-1.859	57	.068	-.477	.257	-.992	.037
	not assumed			-1.631	28.926	.114	-.477	.293	-1.076	.121
Relationship with suppliers	assumed	.240	.626	-1.058	57	.295	-.294	.278	-.851	.263
	not assumed			-1.054	48.867	.297	-.294	.279	-.855	.267
Agreements and contracts with suppliers	assumed	6.399	.014	-1.936	57	.058	-.687	.355	-1.397	.023
	not assumed			-1.786	35.649	.083	-.687	.385	-1.467	.093
Suppliers payment terms	assumed	4.503	.038	-2.189	57	.033	-.530	.242	-1.014	-.045
	not assumed			-2.002	34.405	.053	-.530	.265	-1.067	.008
Suppliers after sales service and warranty offers	assumed	6.366	.014	-2.323	57	.024	-.707	.304	-1.317	-.098
	not assumed			-2.111	33.450	.042	-.707	.335	-1.388	-.026
Products and services specifications	assumed	4.712	.034	-1.622	57	.110	-.486	.299	-1.085	.114
	not assumed			-1.454	31.568	.156	-.486	.334	-1.167	.195
Patterns of products and services demands	assumed	8.597	.005	-3.115	56	.003	-1.040	.334	-1.708	-.371
	not assumed			-2.816	32.327	.008	-1.040	.369	-1.791	-.288
Quality standards	assumed	.351	.556	-1.093	57	.279	-.343	.314	-.971	.285
	not assumed			-1.025	38.373	.312	-.343	.334	-1.020	.334
Total Cost of Ownership (TCO)	assumed	1.327	.254	-.614	57	.542	-.221	.361	-.943	.500
	not assumed			-.593	43.171	.557	-.221	.374	-.975	.532
Safety stock requirements	assumed	3.599	.063	-1.770	57	.082	-.654	.369	-1.393	.086
	not assumed			-1.672	39.455	.102	-.654	.391	-1.444	.137
Economic Order Quantity (EOQ)	assumed	7.777	.007	-2.113	57	.039	-.674	.319	-1.312	-.035
	not assumed			-1.932	34.355	.062	-.674	.349	-1.382	.035
Receiving and inspection of products and services	assumed	.168	.683	-.735	57	.465	-.302	.411	-1.126	.522
	not assumed			-.734	49.386	.466	-.302	.412	-1.130	.525
Purchase requisitions	assumed	.604	.440	-1.135	57	.261	-.388	.342	-1.073	.296
	not assumed			-1.119	46.988	.269	-.388	.347	-1.086	.310
Purchasing survey	assumed	.455	.503	-1.745	57	.086	-.644	.369	-1.383	.095
	not assumed			-1.673	42.026	.102	-.644	.385	-1.421	.133
Market analysis	assumed	.965	.330	-.664	57	.509	-.275	.414	-1.104	.554
	not assumed			-.635	41.586	.529	-.275	.433	-1.149	.599
Material studies and analyses	assumed	.163	.688	-.821	56	.415	-.354	.431	-1.218	.510
	not assumed			-.813	45.685	.420	-.354	.435	-1.230	.522
Environmental factors	assumed	.022	.882	-1.443	57	.155	-.588	.408	-1.404	.228
	not assumed			-1.421	46.809	.162	-.588	.414	-1.421	.245
International trade agreements	assumed	1.117	.295	.462	57	.646	.244	.528	-.813	1.301
	not assumed			.474	53.624	.637	.244	.515	-.788	1.276
Purchasing budget	assumed	1.202	.278	-.006	56	.995	-.002	.386	-.776	.771
	not assumed			-.006	44.252	.995	-.002	.398	-.804	.799
Analysis of sourcing options	assumed	.312	.579	-.032	56	.974	-.015	.459	-.935	.905
	not assumed			-.033	49.546	.974	-.015	.452	-.924	.894
Flow of materials	assumed	.269	.606	-1.342	57	.185	-.537	.400	-1.338	.264
	not assumed			-1.316	46.128	.195	-.537	.408	-1.358	.284

Source: Data are drawn from Question 2.2 (Information type required) and Question 1.1 (Gender of manager)

Table 6.40 Independent-sample T-test on information quality required and gender of managers

	Equal variances	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Conform to rules	assumed	.418	.521	-1.066	54	.291	-.382	.358	-1.100	.336
	not assumed			-1.066	47.386	.292	-.382	.359	-1.103	.339
Reliable	assumed	.608	.439	-.190	57	.850	-.05327	.28027	-.6145	.50795
	not assumed			-.202	56.909	.840	-.05327	.26323	-.5803	.47384
Correct	assumed	.000	.992	-.416	57	.679	-.124	.298	-.720	.473
	not assumed			-.429	54.519	.669	-.124	.288	-.702	.454
Unambiguous	assumed	.013	.909	-.194	57	.847	-.054	.277	-.608	.501
	not assumed			-.203	56.249	.840	-.054	.263	-.581	.474
Meaningful	assumed	.961	.331	-.099	57	.922	-.031	.313	-.657	.595
	not assumed			-.104	56.494	.917	-.031	.296	-.625	.563
Non-redundant	assumed	1.552	.218	-.016	57	.988	-.005	.307	-.619	.609
	not assumed			-.017	56.915	.987	-.005	.288	-.581	.572
Complete	assumed	.884	.351	.355	57	.724	.102	.288	-.475	.679
	not assumed			.382	56.994	.704	.102	.268	-.435	.640
Understandable	assumed	.055	.816	.127	57	.899	.035	.271	-.508	.577
	not assumed			.132	54.829	.896	.035	.262	-.490	.559
Accessible	assumed	.232	.632	-.320	57	.750	-.10119	.31641	-.7347	.53240
	not assumed			-.330	54.432	.743	-.10119	.30655	-.7156	.51328
Easy to access	assumed	.394	.533	-.134	57	.894	-.044	.329	-.702	.614
	not assumed			-.138	54.191	.891	-.044	.319	-.684	.596
Quick to access	assumed	.302	.585	-.503	57	.617	-.158	.315	-.789	.473
	not assumed			-.522	55.212	.604	-.158	.303	-.766	.449
Secure	assumed	.982	.326	-.715	57	.477	-.215	.301	-.819	.388
	not assumed			-.696	44.705	.490	-.215	.310	-.839	.408
Suitably presented	assumed	.005	.942	-.444	57	.659	-.11575	.26054	-.6374	.40597
	not assumed			-.450	51.548	.655	-.11575	.25751	-.6325	.40108
Flexibly presented	assumed	.500	.482	-.276	56	.784	-.088	.320	-.730	.553
	not assumed			-.272	47.377	.787	-.088	.324	-.740	.564
Appropriate to use	assumed	.068	.795	-1.089	57	.281	-.314	.288	-.892	.263
	not assumed			-1.085	48.829	.283	-.314	.290	-.897	.268
Timely	assumed	1.333	.253	.177	57	.860	.048	.268	-.490	.585
	not assumed			.183	54.168	.856	.048	.261	-.475	.570
Suitably formatted	assumed	1.762	.190	-.547	57	.586	-.167	.305	-.777	.443
	not assumed			-.533	45.088	.596	-.167	.312	-.796	.463
Suitably precise	assumed	.061	.806	-.176	57	.861	-.057	.325	-.709	.594
	not assumed			-.180	53.101	.858	-.057	.318	-.696	.581
Suitably measured	assumed	.048	.827	-.462	57	.646	-.130	.281	-.692	.432
	not assumed			-.465	50.472	.644	-.130	.279	-.690	.431
Valuable	assumed	.001	.975	-.442	57	.660	-.130	.294	-.718	.458
	not assumed			-.440	48.860	.662	-.130	.295	-.722	.463

Source: Data are drawn from Question 3.2 (Information quality required) and Question 1.1 (Gender)

6.7.7.2 Independent-sample T-test on information quality required and gender of managers

Table 6.40 presents the independent-sample T-test used to compare means for information quality required by groups of male managers and groups of female managers. The statistics shows that the information quality required from male managers and female managers is not different.

6.8 The reliability and correlation of the scales

The internal consistency of the scales used was confirmed by Cronbach's alpha coefficient (Cronbach1951) value of more than 0.7, which is acceptable (Gliem and Gliem, 2003). Content validity was established from the literature review, expert and practitioner opinions and pre-testing with a small number of respondents. Construct validity was established by the three-decision rules commonly used for factor identification through principal component factor analysis (Nunally, 1967).

Table 6.41 shows the coefficient alphas for the multi-item scales of all variables which reach the adequacy of internal consistency reliability estimates for different values of coefficient alpha at excellent level .90 and above, indicating acceptable reliability (Yockey, 2007).

Table 6.41 Reliability statistics

Variables	Mean	Actual Range	Theoretical Range	Alpha Cronbach* (α)
Information quality required	5.062	3.706-6.441	1-7	.949
Information quality currently available	5.813	4.882-6.441	1-7	.950
Types of information currently available	5.646	5.318-6.076	1-7	.971
Types of information required	6.190	5.940-6.418	1-7	.972

Source: Data are drawn from Question 2.1(Informaiton type avialable),Question 2.2(Informaiton type required),Question 3.1 (Information quality available) and Question 3.2 (Informaiton quality required).

Note : *the conventional values= 0.7

Next, the inter-correlation matrixes are tested to discover how each question is associated with each other or the pair wise correlations among all variables. High correlation means these items probably will be in the same factor.

Next, the inter-correlation matrixes are tested to discover how each question is associated with each other: that is the pair wise correlations amongst all variables will be examined. A high correlation will mean that these items will probably be in the same factor.

Table 6.43 presents an inter-correlation matrix summarising the correlation coefficients between each information type available from the current information systems of the purchasing departments from the Thai manufacturing companies under examination. The sub-scale of information types variable appears to have excellent internal consistency, α =

.949. The detailed statistics from the Table show high correlation coefficients between Marketing analysis and other information items. The highest correlation coefficient value at .902 is the one between Marketing analysis and Material studies analysis. This means that the participant who indicated a 'high available' level for the Marketing analysis information also indicated a 'high available' level on the Material studies analysis. In contrast, the correlation coefficients between 3 pairs of information types: "Names and addresses of potential suppliers" vs. "Suppliers after sales service and warranty offers" (correlation coefficient value at -.057); " Names and addresses of potential suppliers" vs. "Buying environment factors" (correlation coefficient value at -.031); Suppliers after sales service and Warranty offers" vs. "Purchasing requisition" (correlation coefficient value at -.20) show a negative relationship to each other.

Table 6.44 shows how each of the 23 information types is associated with each of the other 22 types. The highest correlation coefficient value can be found in Marketing analysis and Material studies analysis (correlation coefficient value at.880) which means these two information types have a high association with each other and would probably be grouped together by the factor analysis.

Table 6.45 shows how each of 20 information quality characteristics is associated with each of the other 19. The high correlation coefficients can be found among "Reliable" and its sub criteria which are "Correct", "Unambiguous", "Meaningful" and "Non redundant". High correlation coefficients can also be found among the "Accessible" criteria and its sub-criteria which are "Quick access" and "Easy access" (correlation coefficient value at .965 and .965, respectively). The correlation value of the inter-variable is also high between "Appropriately presented" and "Suitably formatted" (correlation coefficient value at .918) quality.

Table 6.46 presents the correlation matrix for 20 of the information quality characteristics required by purchasing managers. The high correlation coefficients can be found among the upper level IQ criteria and their sub-classes: "Reliable" and "Correct", "Unambiguous", "Meaningful" and "Non redundant"; the "Accessible" and "Quick access" (correlation coefficient value at .965) and "Easy access" (correlation coefficient value at .965).

Table 6.42 No. and type of information (to use for Table 6.43 and Table 6.44)

No.	Information types
1	Names and addresses of potential suppliers
2	Reputation for on time delivery
3	Capacity to supply
4	Relationship with suppliers
5	Agreements and contracts with suppliers
6	Suppliers payment terms
7	Suppliers after sales service and warranty offers
8	Products and services specifications
9	Patterns of products and services demands
10	Quality standards
11	Total Cost of Ownership (TCO)
12	Safety stock requirements
13	Economic Order Quantity (EOQ)
14	Receiving and inspection of products and services
15	Purchase requisitions
16	Purchasing survey
17	Market analysis
18	Material studies and analyses
19	Environmental factors
20	International trade agreements
21	Purchasing budget
22	Analysis of sourcing options
23	Flow of materials

Table 6.43 Inter-correlation matrixes -type of information available (Refer to the list no. on Table 6.42)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1.0																						
2	.189	1.0																					
3	.070	.615	1.0																				
4	.261	.483	.424	1.0																			
5	.070	.229	.522	.409	1.0																		
6	.372	.345	.074	.394	.180	1.0																	
7	**-.057**	.419	.660	.382	.701	.130	1.0																
8	.083	.373	.381	.301	.587	.176	.673	1.0															
9	.012	.507	.537	.450	.513	.259	.501	.572	1.0														
10	.030	.396	.744	.401	.546	.059	.644	.350	.605	1.0													
11	.066	.462	.562	.479	.425	.246	.583	.443	.488	.586	1.0												
12	.192	.169	.098	.313	.313	.189	.133	.054	.185	.240	.231	1.0											
13	.024	.280	.575	.296	.656	.083	.721	.456	.513	.679	.590	.395	1.0										
14	.103	.468	.651	.274	.514	.245	.546	.428	.539	.604	.432	.347	.510	1.0									
15	.369	.177	.047	.286	.164	.721	**-.020**	.100	.088	.055	.158	.171	.033	.267	1.0								
16	.015	.382	.568	.401	.494	.211	.469	.267	.554	.669	.484	.456	.646	.487	.191	1.0							
17	.056	.403	.653	.400	.601	.096	.742	.413	.520	.753	.675	.355	.787	.538	.019	.748	1.0						
18	.044	.273	.635	.356	.643	.130	.733	.469	.510	.737	.669	.325	.774	.559	.078	.706	.902	1.0					
19	**-.031**	.296	.622	.248	.624	.119	.788	.510	.430	.646	.579	.210	.745	.495	.066	.606	.820	.849	1.0				
20	.122	.275	.354	.368	.448	.125	.514	.360	.285	.439	.578	.284	.549	.317	.125	.470	.674	.659	.582	1.0			
21	.062	.365	.662	.291	.606	.128	.571	.500	.508	.637	.527	.073	.551	.641	.244	.517	.614	.663	.631	.483	1.0		
22	.063	.368	.636	.329	.495	.109	.623	.327	.595	.732	.647	.320	.704	.543	.052	.728	.845	.840	.702	.618	.612	1.0	
23	.080	.290	.467	.403	.535	.262	.557	.255	.459	.744	.584	.447	.654	.471	.251	.724	.735	.751	.628	.496	.561	.725	1.0

Source: Data are drawn from Question 2.1 (Information available) and N cases= 68 Reliability Coefficients 23 item alpha = .949 Standardized item alpha = .944

Table 6.44 Inter-correlation matrixes -type of information required (Refer to the list no. on Table 6.42)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1.0																						
2	.429	1.0																					
3	.305	.681	1.0																				
4	.385	.296	.382	1.0																			
5	.441	.685	.541	.563	1.0																		
6	.453	.675	.557	.498	.656	1.0																	
7	.394	.622	.749	.455	.612	.610	1.0																
8	.415	.624	.688	.641	.671	.623	.743	1.0															
9	.274	.451	.478	.531	.650	.453	.514	.633	1.0														
10	.195	.622	.519	.379	.521	.500	.670	.563	.595	1.0													
11	.259	.605	.337	.284	.570	.563	.345	.489	.442	.522	1.0												
12	.370	.485	.365	.448	.549	.447	.409	.539	.651	.438	.610	1.0											
13	.271	.427	.421	.368	.480	.422	.450	.466	.685	.601	.528	.663	1.0										
14	.331	.593	.371	.309	.537	.588	.450	.514	.522	.556	.662	.558	.479	1.0									
15	.286	.079	.091	.464	.252	.270	.206	.343	.401	.094	.145	.442	.214	.318	1.0								
16	.278	.453	.353	.398	.506	.478	.423	.518	.556	.478	.579	.583	.642	.598	.364	1.0							
17	.215	.438	.466	.406	.502	.543	.472	.517	.506	.455	.434	.377	.605	.489	.235	.664	1.0						
18	.257	.366	.439	.421	.448	.469	.438	.499	.462	.345	.353	.412	.569	.331	.153	.535	.880	1.0					
19	.160	.458	.398	.239	.495	.521	.461	.354	.367	.444	.505	.360	.510	.538	.165	.602	.685	.614	1.0				
20	.103	.498	.352	.271	.411	.478	.351	.377	.354	.457	.519	.355	.405	.394	.101	.512	.660	.664	.634	1.0			
21	.252	.606	.427	.339	.584	.467	.423	.564	.412	.519	.643	.337	.345	.636	.271	.403	.377	.292	.438	.398	1.0		
22	.107	.461	.353	.314	.511	.514	.411	.385	.337	.452	.490	.319	.448	.487	.078	.571	.627	.654	.807	.758	.506	1.0	
23	.236	.348	.468	.499	.416	.501	.508	.680	.561	.471	.494	.499	.596	.422	.337	.459	.534	.641	.504	.471	.485	.585	1.0

Source: Data are drawn from Question 2.2 (Information required) and N cases= 68 Reliability Coefficients 23 item alpha = .950 Standardized item alpha = .951

Table 6.45 Inter-correlation matrixes - information quality available

	Conforming to rules	Reliable	Correct	Unambiguous	Meaningful	Non redundant	Complete	Understandable	Accessible	Easy Access	Quick Access	Secure	Suitably Presented	Flexible Presented	e Presented	Timely	Suitably formatted	Suitably Precise	Suitably Measure	Valuable
Conforming to rules	1.00																			
Reliable	.829	1.00																		
Correct	.619	***.810***	1.00																	
Unambiguous	.688	***.871***	.811	1.00																
Meaningful	.531	***.849***	.680	.666	1.00															
Non redundant	.492	***.826***	.641	.599	.731	1.00														
Complete	.367	.708	.628	.624	.718	.741	1.00													
Understandable	.360	.613	.476	.460	.576	.705	.748	1.00												
Accessible	.381	.585	.474	.548	.464	.603	.749	.842	1.00											
Easy Assess	.378	.590	.475	.556	.470	.609	.749	.842	***.965***	1.00										
Quick Assess	.358	.540	.440	.500	.425	.555	.697	.784	***.965***	.863	1.00									
Secure	.440	.631	.646	.572	.511	.622	.568	.681	.658	.664	.606	1.00								
Suitably Presented	.482	.680	.637	.650	.566	.618	.783	.757	.808	.814	.745	.714	1.00							
Flexible Presented	.220	.413	.432	.422	.289	.488	.663	.624	.699	.696	.652	.601	.810	1.00						
Appropriate	.467	.671	.614	.635	.559	.625	.783	.773	.824	.828	.761	.714	.997	.828	1.00					
Timely	.464	.616	.657	.624	.525	.480	.663	.528	.599	.622	.534	.581	.863	.578	.841	1.00				
Suitably formatted	.438	.605	.484	.580	.460	.573	.702	.728	.798	.801	.739	.601	.905	.790	***.918***	.655	1.00			
Suitably Precise	.585	.717	.705	.673	.609	.556	.632	.574	.568	.584	.511	.624	.874	.521	.848	.870	.682	1.00		
Suitably Measure	.418	.614	.518	.543	.587	.552	.708	.767	.775	.767	.729	.662	.861	.533	.852	.687	.733	.764	1.00	
Valuable	.419	.518	.429	.519	.389	.422	.558	.743	.770	.765	.720	.557	.768	.553	.770	.570	.738	.621	.812	1.00

Source: Data are drawn from Question 3.1 (Information Quality available) and N cases= 66 Reliability Coefficients 20 item alpha = .971 Standardized item alpha = .973

Table 6.46 Inter-correlation matrixes - information quality required

	Conforming to rules	Reliable	Correct	Unambiguous	Meaningful	Non redundant	Complete	Understandable	Accessible	Easy Access	Quick Access	Secure	Suitably Presented	Flexible Presented	Appropriate Presented	Timely	Suitably formatted	Suitably Precise	Suitably Measure	Valuable
Conforming to rules	1.00																			
Reliable	.830	1.00																		
Correct	.724	***.896***	1.00																	
Unambiguous	.728	***.936***	.913	1.00																
Meaningful	.596	***.902***	.760	.789	1.00															
Non redundant	.604	***.922***	.828	.862	.870	1.00														
Complete	.565	.810	.826	.802	.743	.818	1.00													
Understandable	.596	.769	.754	.797	.664	.716	.784	1.00												
Accessible	.447	.654	.658	.667	.565	.690	.770	.782	1.00											
Easy Assess	.447	.655	.659	.669	.565	.689	.771	.782	***.993***	1.00										
Quick Assess	.440	.644	.647	.655	.556	.680	.758	.769	***.992***	***.970***	1.00									
Secure	.591	.689	.694	.693	.547	.645	.679	.704	.608	.603	.604	1.00								
Suitably Presented	.206	.173	.178	.131	.152	.120	.195	.289	.215	.213	.215	.169	1.00							
Flexible Presented	.449	.603	.572	.627	.526	.576	.595	.782	.743	.729	.745	.661	.350	1.00						
Appropriate	.624	.754	.737	.737	.636	.714	.763	.759	.624	.631	.608	.840	.201	.664	1.00					
Timely	.542	.665	.721	.670	.538	.642	.737	.625	.540	.544	.529	.640	.276	.650	.710	1.00				
Suitably formatted	.435	.589	.558	.598	.519	.574	.616	.567	.581	.580	.572	.656	.391	.665	.695	.688	1.00			
Suitably Precise	.520	.683	.714	.677	.607	.658	.747	.647	.656	.649	.654	.614	.388	.672	.664	.770	.817	1.00		
Suitably Measure	.522	.726	.699	.723	.641	.735	.748	.694	.727	.727	.717	.667	.371	.694	.671	.678	.791	***.905***	1.00	
Valuable	.528	.753	.723	.708	.709	.774	.747	.698	.684	.677	.680	.604	.256	.647	.687	.739	.650	.743	.749	1.00

Source: Data are drawn from Question 3.2(Information Quality required) and N cases= 67 Reliability Coefficients 20 item alpha = .972 Standardized item alpha = .973

6.9 Finding and discussion

6.9.1 Proposition-test results

Proposition 1: There are gaps between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies.

Proposition 1 stated that there is a gap between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies.

According to section 6.4.1, the comparison between the best practice information set and that perceived to be required by purchasing managers shows a gap between the best practice information set and the required information set. The gaps in types of information can be found in section 6.4.1.1 and the gaps in information quality are presented in section 6.4.1.2. Overall, the gaps between the ideal information set and that perceived to be needed by purchasing managers in Thai manufacturing companies exist in the aspects of quality of information and type of information. The gaps between the best practice and required level are significant in four information items: "Market analysis", "Environmental factors", "International trade agreements", "Analysis of sourcing options". These types of information are required information to support decision making at the strategic level. In the information quality aspect, the gaps of each information quality are not significant but some purchasing managers required a higher degree of quality than the best practice level such as "Correct", "Unambiguous", "Complete", "Understandable" and "Timely".

Proposition 2: There are differences between the ideal academic and trade associations suggested information set and the information available from the current enterprise information systems.

Proposition 2 stated that there are differences between the ideal academic and trade associations suggested information set and the information available from the current enterprise information system.

According to section 6.4.2, the comparison and gap analysis between the best practice information set and the currently available information set from current enterprise information systems shows gaps between these two aspects. The detail of gaps in information types and information quality can be found in section 6.4.2.1 and 6.4.2.2, respectively.

As found in this study, gaps between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies can be found in every quality criterion and information type. Most of the gaps are quite small. The results show that only two

information types available from the information system are over the best practice level:"Names and addresses of potential suppliers" and "Suppliers payment terms". The gaps between the two aspects are significantly large (the gap is over 2.0 mean score or about 30% difference), while correct, unambiguous, complete qualities required levels are above the best practice level.

The gaps between the best practice level and currently available from enterprise information systems are quite high (difference between two mean scores more than 1.00) in "Flexibly presented", "Appropriate for use" and "Suitably formatted"

Proposition 3: There are differences between the information perceived to be needed by managers in Thai manufacturing companies and the currently available information set.

Proposition 3 stated that there are differences between perceived to be needed by managers in Thai manufacturing companies information set and the information available from the current enterprise information system.

According to section 6.4.3, the comparison and gap analysis between perceived to be needed by purchasing managers and the information set currently available from enterprise information system shows significant gaps between the two aspects. The gaps in information types and quality are presented in section 6.4.3.1 and 6.4.3.2, respectively.

The difference between the ideal academic and trade associations suggested information set and the information available from the current enterprise information systems can be found in both quality and type aspects. The gaps are not too large but show the requirement to improve the available information to match well with purchasing managers' needs in information types and information quality. This could give some recommendations to system designers and developers both in the organisations and software houses to improve their software products in terms of available level of information types and information quality to match well with the requirements of the information users.

The gaps presented in this study also have the potential to be the guidelines or suggestions for improving the process of adopting the next information systems in purchasing departments of Thai manufacturing companies. The gaps between the available information set and the information perceived to be needed by managers in Thai manufacturing companies are significant in "Understandable", "Flexible presented" and "Appropriate to use".

6.10 Summary

The data and data analyses from the second survey are provided in tabular form and diagrams. The first section presented the detail of the survey process. Second, the results from the survey were provided in terms of response rate, data collection problems, profiles of respondents, company characteristics, types of information system in purchasing departments, types of information in buying decisions, characteristics of information useful for buying decisions. Third, ANOVA analysis was provided. The next chapter will provide the findings, discussions and suggestions from this study.

Chapter 7

Conclusions and Implications

7.1 Introduction

This chapter concludes the investigation of the adequacy of enterprise information systems in Thai manufacturing. The conceptual framework and method of study were proposed in Chapter 3 based on the constructs derived from existing literature in Chapter 2. These propositions were expanded in Chapter 4, and the framework was tested with data from a sample of manufacturing companies. The results from the two surveys of this study can be found in Chapter 5 and Chapter 6. This study provides some insight into the capabilities of information systems currently employed in purchasing departments of Thai manufacturing companies. It also examines the availability of information types and information quality required for buying decisions in large Thai manufacturing companies. Finally, evaluation is made against best practice in academic and trade organisations and that required by information users.

In this chapter, conclusions about propositions, contributions and implications of the research framework and method of study are made. The key findings and the limitations are also discussed. Some suggestions for future research opportunities are provided at the end of this chapter.

7.2 Conclusion and discussion about the research issue

This study has argued that the enterprise information systems deployed in Thai manufacturing companies should provide certain qualitative characteristics of information that are useful for managers' decision-making. More than that, the system should provide information that is useful for managers to make decisions. If the enterprise information systems can meet the users' requirements for information, it may guide management to a better understanding of the true potential of an organisation and its ability to achieve efficient and/or sustainable results. The availability of information was investigated and the gaps between three aspects of information requirements were discovered. The findings showed that the expectation level of the information user in the Thai manufacturing industry is high and the expectation of availability of information

from the current enterprise information systems are below required levels and both information type and information quality dimensions need to be improved.

7.3 Conclusion about the research problems

The complexity of organisational processes and decisions lead to the mismatch between the information users' requirements and that which the information system can provide. The lack of appropriate qualitative characteristics of information and types of information available to managers could result in inadequate decision-making. This research model can identify the needs of information users, in both information types and information quality aspects. The results of this study suggest that the academic and trade association best practice guidelines are capable of assisting management in the redesign of their reporting models to enable optimisation of the decision-making process and to give priority to the real value creation activities and processes within the organisation.

7.4 Implication of research framework

This study framework was developed from the dependent and independent variables found in the information system and management literature. This study examined the current information systems in terms of their ability to provide information only. The ability to provide information was assessed with two variables, the type of information and the quality of information, from three different aspects: the information available from current information systems; the users' needs; and the best practice. The best practice information set and measurement were adopted from the academic and trade associations' literature which are recognised to be simple and possible to be used by information users. The information quality criteria were adopted from the InfoQual framework, based on information theory.

This study framework has strengths and weaknesses in the assessment of information from information systems. First, this framework has the ability to assess the information set in each information type from different aspects: that which is available from current information systems and that which is required by the information user. Second, the best practice level was used to benchmark against the available level and required level of information in an organisation. Third, the framework can be used to generalise other decision topics and in other management areas such as marketing and production. The test of the framework with the purchasing departments

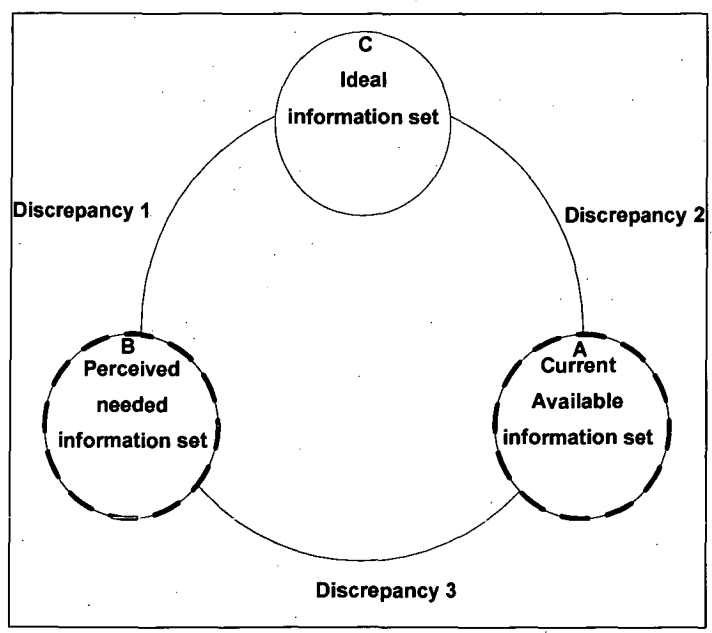
showed that it was capable of generating and assessing the relevant information which implies that the method could be used in other areas to assess the information requirements. Moreover, the purchasing departments in manufacturing companies are dealing with most of the possible types of information in order to obtain the resources such as material to produce the goods, the services to fulfil the needs which is sufficiently complex that the framework could be applied to the buying decisions of service providers and trading companies.

However, there are some weaknesses to be aware of in the framework and to take preventative action. First, the list of information types from the literature should be developed based on the scope of the decisions and the responsibilities and tasks of the information users. Second, the information types should be related to the level of management such as strategic decisions, tactical decisions or day-to-day decisions.

7.4 Implication of Method of Study

The method of study was designed to assess the gaps among the three aspects of information available to Thai manufacturing companies. The level of availability is measured against the required level which shows whether the information available fulfils the needs of users. The best practice level of this study was used to benchmark against the available level and required level of information. At the beginning, the proposed method of study was as shown in Figure 7.1.

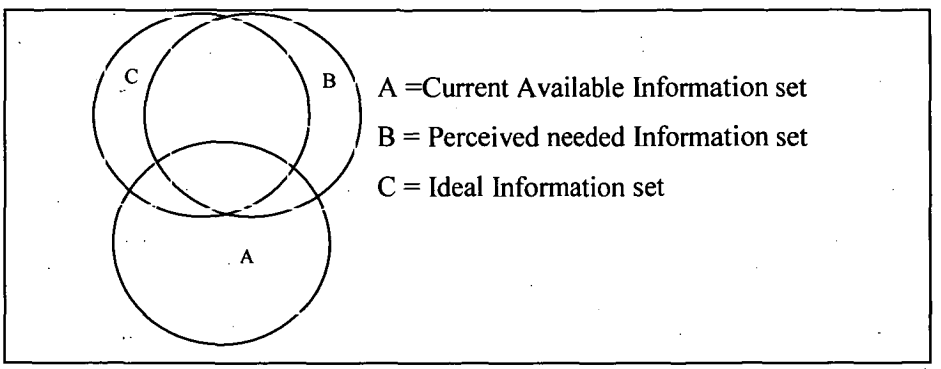
Figure 7.1 The previous method of study



Source: developed from literatures

The results of this study reveal the existence of gaps among the three information sets. However, the size of the gaps between information sets vary in each pair. The model, after adjustment is presented in Figure 7.2 which shows that the ideal information set and the perceived needed information set match well with the ideal set. In contrast, the currently available information set differs from the other two significantly. The ideal information set possibly represents the perceived needs well, but it is not the same. This could help system designers or information users to adopt the academics and trade association best practices as guidelines but the information users should have the chance to make comments on the best practices before following the best practice guidelines. More details of the current models are provided in Figure 7.3, Figure 7.4 and Figure 7.5.

Figure 7.2 The currently model

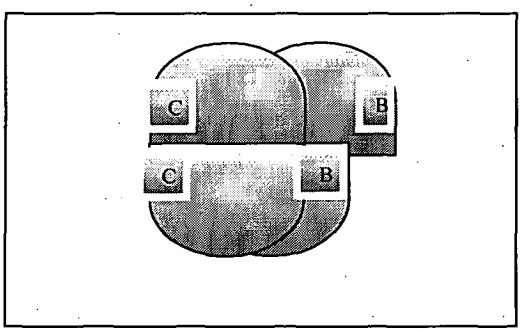


Source: generated from the survey data

A =Current Available Information set, B = Perceived needed Information set, C = Ideal information set

= Information types = Information Quality

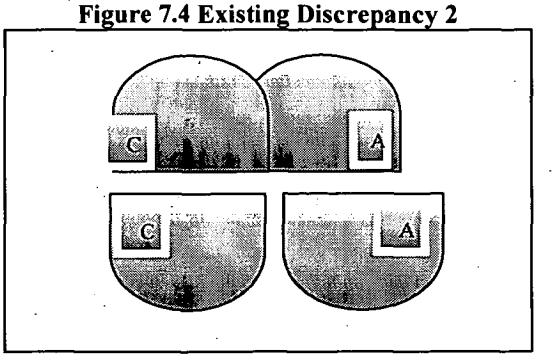
Figure 7.3 Existing Discrepancy 1



Source: generated from the survey data

Figure 7.3 presents the pattern of discrepancy 1, between the ideal information set and the required information set in existing Thai manufacturing companies. This discrepancy was reported as significant in some information types and on almost every information quality criterion.

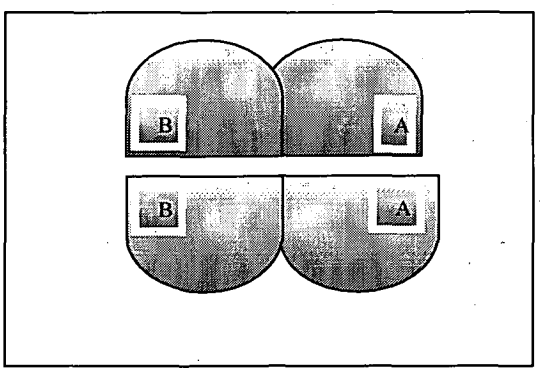
Figure 7.4 Existing Discrepancy 2



Source: generated from the survey data

Figure 7.4 presents the discrepancy between the ideal information set and the currently available information set which has differences in information type and information quality in Thai manufacturing companies. The gaps between the two aspects are totally different in the information quality aspect but shared some similarities in some information types.

Figure 7.5 Existing Discrepancy 3



Source: generated from the survey data

Figure 7.5 shows the discrepancy between the currently available information set and the required information in the aspects of both information type and information quality. The information quality is different in the two information sets while similarity can be found in some information types.

7.5 Conclusion about the research propositions

This research project has successfully examined the ability of enterprise information systems in Thai manufacturing companies to meet the information requirement of their users.

7.5.1 Gaps between best practice level and perceived to be needed by managers in Thai manufacturing companies

Proposition 1 stated that there are gaps between the ideal information set and that perceived to be needed by managers in Thai manufacturing companies.

The current information requirements practice of Thai manufacturing companies were assessed against the best practice guidelines. Significant differences in both information type and information quality dimensions were found.

7.5.2 Gaps between best practice level and information currently available from enterprise information system of Thai manufacturing companies

Proposition 2 stated that there are differences between the ideal academic and trade associations information set and the information available from the current enterprise information systems. Benchmarking to test the proposition showed significant differences between the available levels and the best practice levels of information in both type and information quality dimensions, in Thai manufacturing companies.

7.5.3 Gaps between information perceived to be needed by managers in Thai manufacturing companies and currently available from enterprise information systems

Proposition 3 stated that there are differences between the information perceived to be needed by managers in Thai manufacturing companies and the information actually available from the current enterprise information system. The test of this proposition reported significant differences between required level and available level of information both in type and quality dimensions, in Thai manufacturing companies. The proposition test showed that the current information systems in Thai manufacturing need to be improved to meet the information requirements of the users.

7.6 Implication for information requirement in decisions

According to the results from the first survey of this study, some information users are unable to identify the information types needed in their decision making but they can identify the information quality problems. Using the academic and trade association literature to develop the respective information types required for specific decisions could help users to identify their requirements. However, not all information items suggested by the academics and trade associations are perceived to be needed by the information users. This suggests that both managers and system designers ought to study the underlying businesses more thoroughly.

The information systems currently in use have the ability to provide day-to-day information to support decision making but the level is significantly lower when it comes to providing strategic support information. This implies that managers need to specify what they see as strategic support information. It also implies that system designers need to recognise that different levels of management may require information of different types and qualities. The academic and trade association best practice may guide management to a better understanding of the true potential of an organisation and its ability to achieve efficient and/or sustainable results; also systems designers might be able to use the findings to design better enterprise information systems. This study identified the gaps of information requirements in the buying task that could be used to improve the system products to suit the information requirements of Thai manufacturing.

7.7 Implication of best practice against the real world

The list of information types in buying decisions adopted to investigate the information requirement of purchasing managers shows the potential of the best practice from the academic and trade organisations point of view in the real world situation.

7.8 Limitation

7.8.1 Sample coverage

The study was limited to a survey of the purchasing departments of the large Thai manufacturing companies listed on the Security Exchange of Thailand (SET). However, the enterprise information systems covered almost all departments of the companies which need to be studied in the future.

7.8.2 Response rate

A thirty-one percent response rate is considered low in survey research but the non-response bias analysis was conducted to make sure no bias existed. This led to the belief that the data collected from the survey process can be used to represent the population of the study. A number of strategies was implemented to boost the response rate. However, the school-letter head, the reminder letter, etc were not sufficient to encourage a higher response rate from large Thai manufacturing companies.

7.9 Implication for further research

The area of information use still lacks in-depth study. This research framework and the method of study have potential to be applied to assess the ability of information systems to provide information and could be used to evaluate the information requirements from the users' perspective and the best practice perspective. However, the framework needs to be tested in different types of information system, populations and decision topics. Moreover, future adopters need to be aware of the limitations and the weaknesses of the framework as well. The system designers could apply this framework to the system development process by gathering the information requirement based on the user requirements and the best academic and trade association practices in order to have the potential to help users to identify their needs more clearly.

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Appendix A: The first survey

CONSENT FORM

Title of Project: An Information Supported Decision Making Model for Enterprise Information System to Optimize Thai Company Management

1. I have read and understood the 'Information Sheet' for this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves an audio-taped and transcribed 30-40 minute interview on decision-making, and use of information supporting decision making, in my organisation.
5. I understand that all research data will be securely stored on the University of Tasmania premises for five years, and will then be destroyed.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered from me for the study may be published provided that I and my organisation cannot be identified as a participant.
8. I understand that the researchers will maintain confidential my identity and that of my organisation as participants in this study, and that any information I supply to the researcher(s) will be used only for the purposes of the research.
9. I agree to participate in this investigation and understand that I may withdraw at any time without any effect, and if I so wish, may request that any data I have supplied to date be withdrawn from the research.

Name of Participant:

Signature: Date:

Statement by Investigator

☐ I have explained the project & the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the Information Sheet where my details have been provided so participants have the opportunity to contact me prior to consenting to participate in this project.

Name of Investigator

Signature of Investigator

Name of investigator

Signature of investigator Date

Information Sheet

October 2006

Title of investigation An Information Supported Decision Making Model for Enterprise Information System to Optimize Thai Company Management

Invitation

I am a doctoral student in the School of Accounting and Corporate Governance at the University of Tasmania, Australia. My name is Ms Thunyanee Pothisarn, and I am undertaking this doctoral research under the supervision of Associate Professor Dr. Trevor Wilmshurst. My research is in accounting information technology area - the title of my doctorate is "An Information Supported Decision Making Model for Enterprise Information System to Optimize Thai Company Management". The intention of this study is to develop an information model to support decision making in Enterprise Information System for Thai company management.

I would like to invite your participate in this research. Your participation, though, remains entirely voluntary.

Purpose of the study

The information model is an organisational framework used to categorize information resources. This framework assists the information implementation team and users in finding what information they need, even if their needs are significantly different and personal. Therefore, developing the information framework to meet the needs of their business will kept to ensure that the information provided from Enterprise Information System is useful for corporate management, especially business decision making. The information supported decision making model for Enterprise Information System to optimize Thai Company Management research is intended to develop an information model compatible with Thai company management compatible with their business environment, Accounting standards ,and laws and regulations. The interview is the first stage in this process.

The research aims to develop the information supported decision making model to optimize Thai company management and appropriated to use in Thai company management by defining decision making in Thai company management and its supported report and information.

What your participation would involve

The interview will be undertaken at a time convenient to you, and will take 30-40 minutes. The interview questions will focus on decision making in Thai business and information using in the existing environment – the interview schedule is attached. I will ask for job descriptions of management levels in the company and reports and blank forms used in the company. The result of this exploration will result in the requirement of data and information report represented in the Resource-Event-Agent model (REA) and Unify Model Language (UML) form. Next, the REA Model and the UML diagram will be interpreted and used to create the research questionnaires for each department. The data collected during the interview will be

used to create a prototype information model. Once this model is developed, surveys will be sent to the top 100 Thai companies for the purposes of seeking views on the model.

I would like to ask your permission to audio-tape the interview to ensure accurate transcription of what you say. If you would like to review a transcript of your interview, and edit or modify it, I can supply this.

Confidentiality and anonymity

In all uses of this data your anonymity will be maintained. In any published work, including the dissertation, you and your company will not be identified or identifiable. The transcript of your interview will be unidentified; any references to your company and individuals will be replaced with pseudonyms. Moreover, any potentially identifiable scenarios will be generalised or not reported.

The data collected for this research will be kept for 5 years from publication at University of Tasmania School of Accounting and Corporate Governance, Tasmania, Australia. Please note that audio-tape of your interview will be destroyed once you have approved the content of your interview.

Voluntariness and withdrawal

Remember that your participation is voluntary. It is evidenced by signing a consent form at the interview. In any case, you may decline to answer any question, and may terminate the interview and withdraw from the study at any time (and withdraw any data you have contributed to date).

Contact persons

If you have any queries about my research or its use, you can contact:

Thunyaneee Pothisarn
Accounting Department
Faculty of Business Administration
Chiang Mai University
Chiang Mai 50200 Thailand
Tel: +66816960719
Email : tp2@utas.edu.au
(From October 2006-December 2006)

Dr. Trevor Wilmshurst
Assoc. Prof.
Locked Bag 1314
Launceston Tas 7248,
AUSTRALIA
Phone: 61-3-6324-3570
Email: Trevor.Wilmshurst@utas.edu.au

Ethics approval and contacts

This project has been approved by the Human Research Ethics Committee (Tas) Network, (Approval No H9122). Should you have any concerns or complaints concerning the manner in which this research is conducted, please contact the Acting Executive Officer of the Network, Marilyn Pugsley, at Marilyn.Pugsley@utas.edu.au

Thank you for taking the time to read this information sheet. I will make contact with you in the near future to ascertain whether you are willing to participate.

THE QUESTIONNAIRE

This questionnaire will be used with top manager

SECTION 1: Company profile and Enterprise Information System (EIS) using in company

Please tick √ the appropriate box that corresponds to your answer to each question.

1. What is your company industry type(s)? (Please tick √ as many as are relevant to you)
   - ☐ Retail
   - ☐ Wholesale
   - ☐ Service
   - ☐ Production
   - ☐ Other (Please specify) _____

2. What is/are your main business area(s)? (Please tick √ as many as are relevant to you)
   - ☐ Daily products
   - ☐ Agricultural products
   - ☐ Health products
   - ☐ Vehicle
   - ☐ Mineral and fuel
   - ☐ Furniture, wood and paper
   - ☐ Clothing, textile
   - ☐ Jewellery, and gems
   - ☐ Other (Please specify) _____

3. What are your company business values, please explain? (Please tick √ as many as are relevant to you)
   - ☐ Shareholder Value _____
   - ☐ Customer Value _____
   - ☐ Employee Value _____
   - ☐ Channel Partner Value _____
   - ☐ Shareholder Value _____
   - ☐ Supplier Value _____
   - ☐ Managerial Value _____
   - ☐ Societal Value _____
   - ☐ Other (Please specify) _____

4. What is your business missions and goals?

_____
_____
_____

5. Which are the business processes in your company? (Please tick √ as many as are relevant to you)

☐ Purchasing	☐ Inventory	☐ Production
☐ Marketing	☐ Customer Service	☐ Administration
☐ Accounting	☐ Finance	☐ Human Resource
☐ Production Planning	☐ R&D	☐ IT/MIS

☐ Others _____

6. Are there specific laws and regulation affecting the business you undertake?

☐ Yes, ***please answer Question 7*** ☐ No, ***go to Question 8***

7. What are the laws and regulation mentioned about?

_____

_____

8. Do you have an Enterprise Information System operating in your company?

☐ Yes, ***please answer Question 9*** ☐ No, End of Interview

9. How was your Enterprise Information System developed?

☐ Application Software, ***go to Question 10***

☐ Custom Software – In House Development, ***please answer Question 11***

10. Which application software it is?

☐ SAP R/3	☐ Oracle Finance	☐ Great Plane
☐ JD Edward	☐ Navision	☐ BANN

☐ Other, Please specific _____

11. Is this software able to integrate all functions/processes with in your business?

☐ Yes ☐ No, ***please answer Question 12***

12. What are functions/processes in your business this application software not supported?

_____

_____

13. Who/what company helped you design it?

_____

_____

THANK YOU VERY MUCH FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

THE QUESTIONNAIRE

This questionnaire will be used with each department manager

SECTION 1: Business Function

1. Which are the business processes in your department? (Please tick √ as many as are relevant to you)

☐ Purchasing	☐ Inventory	☐ Production
☐ Marketing	☐ Customer Service	☐ Administration
☐ Accounting	☐ Finance	☐ Human Resource
☐ Production Planning	☐ R&D	☐ IT/MIS
☐ Others _____		

2. Could you explain your department process concept map or draw one?

Department' process concept map. <Please draw>

3. Does your department or senior management set performance targets?

☐ Yes, please explain ☐ No, ***go to Question 5***

4. What are the performance targets your department is required to achieve?

5. Do you believe that your department is faced with obstacles to achieving their performance targets?

☐ Yes, please explain ☐ No, ***go to Question 6***

6. What changes or additional inputs do you think could assist in improving performance to target?

7. Do you believe a part of the issue is the quality of information currently available for making good decision in your department to meet the targets?

☐ Yes, ***go to Section 2*** ☐ No, please explain

SECTION 2: Decision Making in Business Function

1. What types of decision do you normally need to make in your department – in this question I need you to think about the types of decisions you or your staff or higher echelon management affecting your department make – short and longer term – and the type of decision

Type of Short Term Decision	Decision Making Subject	Decision Maker
Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
Semi Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
Non Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	

Type of Long Term Decision	Decision Making Subject	Decision Maker
Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
Semi Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
Non Structure Decision	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	

SECTION 3: Reports and Information Used to Support Decision Making

1. Do you need information to support decision making?

   ☐ Yes, ***ask Question 2 to 13*** ☐ No, ***go to Question 13***

2. Is the information best presented in a report to enhance your understanding?

3. What are these report you need to make decision?

4. Are these reports able to meet your needs?
   ☐ Yes, ***Please answer Question 4.1*** ☐ No, ***Please answer Question 4.2***

   4.1 If so, what are these characteristic of these reports that make them useful?

   4.2 If not, what are the characteristic of these reports that will make them useful?

5. How often you use these reports or information to support you decision making?

Time / Frequency	Report	Information

6. What role do they play in decision making?

7. Where you can find those reports or information?

8. What data and information are shown in each report?

9. Which are the important elements in those reports you use to support decision?

10. Do you need to reformat or do other formula before use those reports or information?

11. Do those reports or information support decision making?

12. How would you classify the quality of those current report and information?

13. Do you need other reports or information to support decision making?

14. What kind of data needs to be present in the reports or information you mentioned in question 13?

THANK YOU VERY MUCH FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNARIRE AND

Appendix B: The second survey

School of Accounting and Corporate Governance UTAS

Month 2009
Dear Purchasing Manager

My name is Thunyanee Pothisarn, a PhD candidate in Accounting, School of Accounting and Corporate Governance, Faculty of Business, University of Tasmania. The title of my doctorate is 'Optimal Decision Making by Thai Manufacturer: Focus on the Enterprise Information System'. The aim of this study is to examine the information needs of selected Thai manufacturing companies against a list of academic and trade associations 'best practice' criteria for the acquisition of necessary quality information as found in the management literature and determine if their current enterprise information systems are providing them with the best available information to make informed management decisions. Information provided by a questionnaire to the purchasing managers of the participating manufacturing companies will be examined using the Gap Analysis Model that has been developed for this study. Gathered information will be compared for type and quality characteristics with the type and quality of information considered to be 'best practice'. The Gap Analysis Model also provides for the examination of what type of enterprise information system is currently providing the Thai Manufacturing companies with their information. Using the devised model this study will determine if there is any gap between 'best practice', information needs and the information provided by existing systems. Any gap between information needs and the quality of information made available under current enterprise information systems, such that the ability of management to make well informed decisions is affected, will be made public through the thesis and personal setup website at www.ba.cmu.ac.th/~thunp/phd/bestpractice.html. An 'industry information standard of practice' for Thai manufacturing companies could be devised from an analysis of all the information provided.

I am undertaking this research under the supervision of Professor Robert Charles Clift and Associate Professor Trevor Wilmshurst in the School of Accounting and Corporate Governance, Faculty of Business, University of Tasmania, Australia.

To allow me to gather information, I would like to invite you to be a part of my study process and hope that you will spend about 30 minutes to participate in this survey. After you read this invitation to participate, I would like to ask you to read the information sheet provided in this survey kit. If you want to participate in this study, please read the questionnaire instruction available on the first page of the questionnaire. Then, I would like you to complete the questionnaire. The questionnaire is divided into three sections. The first section covers the demographic data of the participants. The second section comprises the type of information needed by purchasing managers and the type of information available through the current enterprise information system. The third section will cover the quality characteristics of the both the information needed and that which is provided. After you complete the questionnaire, Please return it using the prepaid envelope by 25 September 2009.

Yours sincerely,
Thunyanee Pothisarn

PARTICIPANT INFORMATION SHEET (PROFORMA) (Document No.2)
SOCIAL SCIENCE/ HUMANITITES
RESEARCH

'Optimal Decision Making by Thai Manufacturer: Focus on the Enterprise Information System'.

1. Invitation

You are invited to participate in a research study into exploring the information available from the Enterprise Information Systems of Thai organisations and seeking to identify the information model that supports management decision making.

The study is being conducted by Thunyanee Pothisarn, a PhD candidate in Accounting, School of Accounting and Corporate Governance, Faculty of Business, University of Tasmania. under the supervision of Professor Robert Charles Clift and Associate Professor Trevor Wilmshurst in the School of Accounting and Corporate Governance, Faculty of Business, University of Tasmania, Australia.

2. 'What is the purpose of this study?'

The purpose is to investigate whether the current enterprise information system adopted by your company can adequately meet your information requirements in term of types and quality of information to support your decision making.

3. 'Why have I been invited to participate in this study?'

You are eligible to participate in this study because your company is a large Thai manufacturing company in one of the six industrial groups listed in The Stock Exchange of Thailand. It is expected that your company has adopted an enterprise information system in order to provide information to support your buying decision making.

4. 'What does this study involve?'

In order for me to gather information, I would like you invite you to be a part of my study process and hope that you will spend about 30 minutes to participate in this survey. After you read this invitation to participate, I would like to ask you to read the information sheet provided in this survey kit. If you want to participate in this study, please read the questionnaire instruction available on the first page of the questionnaire. Then, I would like you to complete the questionnaire. The questionnaire is divided into three sections. The first section covers the demographic data of the participants. The second section comprises the type of information needed by purchasing managers and the type of information available through the current enterprise information system. The third section covers the quality characteristics of the both the information needed and that which is provided. After you complete the questionnaire, Please return it using the prepaid envelope by 25 September 2009.

Please note that completion of the questionnaire is regarded as implicit consent to participate.

It is important that you understand that your involvement is this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate. If you decide to discontinue participation at any time, you may do so without providing an explanation. All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research as the results will be published in aggregated form only. All of the research will be kept in a locked cabinet in the office of the School of Accounting and Corporate Governance, University of Tasmania for 5 years. After the 5 year date from publication, all written data and paper documents which have been stored in a locked cabinet within the School of Accounting and Corporate Governance located in Hobart Campus will be shredded. The soft copy of all data stored in the researcher's computer which is located at Room 115 Building D will be reformatted by IT staff to erase data once the doctorate program has been completed and the researcher has returned to Thailand.

5. Are there any possible benefits from participation in this study?

It is possible that you will notice the 'best practice' types and quality of information suggested by academics and trade associations from the program after a certain period of time. This may lead to identifying your needs of information and might result in the improvement of the enterprise information systems in the future. As the results of this study are anonymous and summary, the summary results of this study will be available for you on my personal website at www.ba.cmu.ac.th/~thunp/phd/bestpractice.html.

6. Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study.

7. What if I have questions about this research?

If you would like to discuss any aspect of this study please feel free to contact either Thunyaneee Pothisarn on phone +61-3-6324-3480 (email: tp2@utas.edu.au) or Professor Robert Charles Clift on email: Robert.Clift@utas.edu.au. Either of us would be happy to discuss any aspect of the research with you. You are welcome to contact us at that time to discuss any issue relating to the research study.

This study has been approved by the Tasmanian Social Science Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study should contact the Executive Officer of the HREC (Tasmania) Network on +61-3-6226-7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. You will need to quote H10712.

Thank you for taking the time to consider this study.
This information sheet is for you to keep.

School of Accounting and Corporate Governance UTAS

SURVEY QUESTIONS

The instruction **(Document No. 3)**

This study is aimed at examining the information available from current enterprise information systems and how well it meets the decision-making needs of managers. This research is confined to the **purchasing** activities of Thai manufacturing companies. Production, sales, marketing, human resources, accounting and finance activities undertaken or occurring within the companies are not the subject of this investigation. Please complete this survey as this will assist the researcher in gaining an understanding of the information flows and needs in Thai manufacturing companies. Your answers will remain strictly confidential. Most of the questions can be answered by ticking the boxes provided. We would be grateful if you would return the completed questionnaire by **25 September 2009**.

For ease of completion, the survey has been divided into 3 sections.

Section 1 Demographics data (Managers, organisations and enterprise information systems)
Section 2 Types of purchasing information in buying decision-making (availability of information from enterprise information system and the information needed for decision-making).
Section 3 Characteristics of information useful to buying decision-making (qualitative characteristics of information currently available from enterprise information systems and the ideal characteristics of information useful to decision-making).

The survey should take approximately **30 minutes** to complete.

Definition of terms used for the purpose of this survey.	
Decision-making	Decision-making is a process of choosing from a set of alternatives.
Enterprise Information System(EIS)	EIS is software that has the ability to integrate the communication channels and information processing systems needed in business operations.
In-house development software	In-house development means the software that has been developed within the firm based on user needs.
Commercial software package	Commercial software package refers to generic pre-coded commercial software packages that have been rigorously tested by the vendor.

Please answer each question as directed.

QUESTIONNAIRE (Document No. 4)

Section 1: Demographics data

	Please Tick one
1.1 What gender are you?	(√)
1. Male	□
2. Female	□
1.2 How old are you?	(√)
1. 25- under 35 years old	□
2. 35-45 years old	□
3. Above 45 years old	□
1.3 Where did you achieve the highest level of education?	(√)
1. in Thailand	□
2. Overseas, please specify the country_____	□
1.4 What is the highest educational qualification that you hold?	(√)
1. Less than a degree	□
2. Degree	□
3. Master's degree	□
4. Doctorate	□
1.5 How long have you worked in your current position?	(√)
1. Less than 5 years	□
2. 5 - 10 years	□
3. more than 10 years	□
1.6 To which industrial group does your company belong?	(√)
1. Agro & Food industry	□
2. Consumer Products	□
3. Industrials	□
4. Property & Construction	□
5. Resources	□
6. Technology	□
7. Other Please specify_____	□
1.7 How many employees in your company?	(√)
1. Less than 50	□
2. 51- 200	□
3. more than 200	□
1.8 What information system do you currently use to produce information to support decision-making in your department?	(√)
1. Manual system	□
2. In-house developed software for department only	□
3. In-house developed enterprise integrated software (integrate all business functions)	□
4. Commercial software package (e.g., POS, Express, MYOB, AccPack etc.)	□
5. Enterprise Resource Planning package (e.g., SAP, Baan, J.D. Edward, Oracle Finance, Great Plane etc.)	□

Section 2: Type of information available

2.1 What types of information are **available** from your current enterprise information system? Please indicate the level of availability of each type of information from your current enterprise information system by ticking (√) the appropriate box (es).	Not available at all			Neutral			Totally
The current enterprise information system is able to provide information about:	1	2	3	4	5	6	7
1. Names and addresses of potential suppliers	□	□	□	□	□	□	□
2. Reputation for on time delivery	□	□	□	□	□	□	□
3. Capacity to supply	□	□	□	□	□	□	□
4. Relationship with suppliers	□	□	□	□	□	□	□
5. Agreements and contracts with suppliers	□	□	□	□	□	□	□
6. Suppliers payment terms	□	□	□	□	□	□	□
7. Suppliers after sales service and warranty offers	□	□	□	□	□	□	□
8. Products and services specifications	□	□	□	□	□	□	□
9. Patterns of products and services demands	□	□	□	□	□	□	□
10. Quality standards e.g., industrial standards, material standards	□	□	□	□	□	□	□
11. Total cost associated with the acquiring, possessing and sustaining of a given product and service(Total Cost of Ownership: TCO)	□	□	□	□	□	□	□
12. Safety stock requirements	□	□	□	□	□	□	□
13. Economic Order Quantity (EOQ)	□	□	□	□	□	□	□
14. Receiving and inspection of products and services	□	□	□	□	□	□	□
15. Purchase requisitions	□	□	□	□	□	□	□
16. Purchasing survey	□	□	□	□	□	□	□
17. Market analysis	□	□	□	□	□	□	□
18. Material studies and analyses	□	□	□	□	□	□	□
19. Environmental factors e.g., government and economic factors	□	□	□	□	□	□	□
20. International trade agreements	□	□	□	□	□	□	□
21. Purchasing budget	□	□	□	□	□	□	□
22. Analysis of sourcing options	□	□	□	□	□	□	□
23. Flow of materials	□	□	□	□	□	□	□

2.2 What are the **types of information** you **require** to make a good purchasing decisions? Please indicate the level of need of each type of purchasing information you need in your decision-making by ticking (√) the appropriate box (es).	Not at all			Neutral			Totally in
To make a good purchasing decision, you **require** information about:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Names and addresses of potential suppliers	□	□	□	□	□	□	□
2. Reputation for on time delivery	□	□	□	□	□	□	□
3. Capacity to supply	□	□	□	□	□	□	□
4. Relationship with suppliers	□	□	□	□	□	□	□
5. Agreements and contracts with suppliers	□	□	□	□	□	□	□
6. Suppliers payment terms	□	□	□	□	□	□	□
7. Suppliers after sales service and warranty offers	□	□	□	□	□	□	□
8. Products and services specifications	□	□	□	□	□	□	□
9. Patterns of products and services demands	□	□	□	□	□	□	□
10. Quality standards e.g., industrial standards, material standards	□	□	□	□	□	□	□
11. Total cost associated with the acquiring, possessing and sustaining of a given product and service(Total Cost of Ownership: TCO)	□	□	□	□	□	□	□
12. Safety stock requirements	□	□	□	□	□	□	□
13. Economic Order Quantity (EOQ)	□	□	□	□	□	□	□
14. Receiving and inspection of products and services	□	□	□	□	□	□	□
15. Purchase requisitions	□	□	□	□	□	□	□
16. Purchasing survey	□	□	□	□	□	□	□
17. Market analysis	□	□	□	□	□	□	□
18. Material studies and analyses	□	□	□	□	□	□	□
19. Environmental factors e.g., government and economic factors	□	□	□	□	□	□	□
20. International trade agreements	□	□	□	□	□	□	□
21. Purchasing budget	□	□	□	□	□	□	□
22. Analysis of sourcing options	□	□	□	□	□	□	□
23. Flow of materials	□	□	□	□	□	□	□

Section 3: Characteristics of information useful to decision-making

3.1 Which of the following quality characteristics of information **can be found** from the buying related information produced **from your enterprise information system**? Please indicate the level of importance of that characteristic of information to your decision-making in your department by ticking (√) the appropriate box (es).	Not available at all			Neutral			Totally available
The information from current EIS:	1	2	3	4	5	6	7
1. Obeys business and other integrity rules.	□	□	□	□	□	□	□
2. Is correct.	□	□	□	□	□	□	□
3. Is unambiguous.	□	□	□	□	□	□	□
4. Is meaningful.	□	□	□	□	□	□	□
5. Is non-redundant.	□	□	□	□	□	□	□
6. Includes all the information needed for your use of this data.	□	□	□	□	□	□	□
7. Is presented in a manner easy to interpret.	□	□	□	□	□	□	□
8. Is easy to access.	□	□	□	□	□	□	□
9. Is quick to access.	□	□	□	□	□	□	□
10. Is appropriately protected from damage or abuse.	□	□	□	□	□	□	□
11. Can be easily manipulated and presentation customised as needed.	□	□	□	□	□	□	□
12. Is presented in a manner appropriate for you use of this data.	□	□	□	□	□	□	□
13. Is timely.	□	□	□	□	□	□	□
14. Is suitably formatted.	□	□	□	□	□	□	□
15. Is suitably precise.	□	□	□	□	□	□	□
16. Is suitably measured.	□	□	□	□	□	□	□
17. Is used and is sufficient for your use of this data.	□	□	□	□	□	□	□

3.2 Which of the following ideal quality characteristics of information **do you think you need** in your buying decision-making? Please indicate the level of importance of that information characteristic in your decision-making by ticking (√) the appropriate box (es).	Not at all			Neutral			Totally in need
The information that you think you need:	1	2	3	4	5	6	7
1. Obeys business and other integrity rules.	□	□	□	□	□	□	□
2. Is correct.	□	□	□	□	□	□	□
3. Is unambiguous.	□	□	□	□	□	□	□
4. Is meaningful.	□	□	□	□	□	□	□
5. Is non-redundant.	□	□	□	□	□	□	□
6. Includes all the information needed for your use of this data.	□	□	□	□	□	□	□
7. Is presented in a manner easy to interpret.	□	□	□	□	□	□	□
8. Is easy to access.	□	□	□	□	□	□	□
9. Is quick to access.	□	□	□	□	□	□	□
10. Is appropriately protected from damage or abuse.	□	□	□	□	□	□	□
11. Can be easily manipulated and presentation customised as needed.	□	□	□	□	□	□	□
12. Is presented in a manner appropriate for you use of this data.	□	□	□	□	□	□	□
13. Is timely.	□	□	□	□	□	□	□
14. Is suitably formatted.	□	□	□	□	□	□	□
15. Is suitably precise.	□	□	□	□	□	□	□
16. Is suitably measured.	□	□	□	□	□	□	□
17. Is used and is sufficient for your use of this data.	□	□	□	□	□	□	□

Thank for your cooperation in completing this questionnaire.

Private Bag 1314 Launceston
Tasmania Australia 7250
Phone +61 3 6324 3482 Fax +61 3 6324 3369
Tp2@utas.edu.au

UTAS

25 September 2009

Dear Purchasing Manager

My name is Thunyanee Pothisarn, a PhD candidate in Accounting, School of Accounting and Corporate Governance, Faculty of Business, University of Tasmania. The title of my doctorate is 'Optimal Decision Making by Thai Manufacturer: Focus on the Enterprise Information System'. I recently invited you to participate in my study and sent you a survey package by Australian Post on 28 August 2009.

I would like to remind you about my survey package and hope that you will spend about 30 minutes to participate in my survey. Your participation will help me to get important data. After you complete the questionnaire, Please return it using the prepaid envelope in the survey package by 9 October 2009. Thank you in advance for your help and hope to receive the completed questionnaire from you soon.

Yours sincerely,

Thunyanee Pothisarn